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The Continuous Flow Analyzer Automation System
Part III -- Program Documentation

Cincinnati Univ. Computing Center, OH

Prepared for

Environmental Monitoring and Support Lab.
Cincinnati, OH

Apr 82

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EPA-600/4-81-066
April 1982

PB82-199969

THE CONTINUOUS FLOW ANALYZER AUTOMATION SYSTEM
PART III -- PROGRAM DOCUMENTATION

by

Jonathan E. Kopke
University of Cincinnati Computer Center
Cincinnati, Ohio 45220

Contract No. GS-05S-10458

Project Officer

John M. Teuschler
Physical and Chemical Methods Branch
Environmental Monitoring and Support Laboratory
Cincinnati, Ohio 45268

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16. ABSTRACT

This report contains complete documentation for the 21 programs and eight data files of the EPA Continuous Flow Analyzer Automation System. This system can receive lists of samples from the Sample File Control System and return the measured concentrations to that system. It is capable of interfacing with three continuous flow analyzer detectors simultaneously. It incorporates the following major features: 1) baseline interpolation between blanks, 2) multi-point calibration using first, second, or third degree regression or linear interpolation, 3) timely quality control assessments for spiked samples, duplicates, laboratory control standards, reagent blanks, and instrument check standards, 4) reagent blank subtraction, and 5) plotting of calibration curves and raw data peaks.

In this document, there is a functional description, a symbol definitions table, a functional flowchart, a program listing, and a symbol cross reference table for each program. The structure of every data file is also detailed.

Two related publications are titled, "The Continuous Flow Analyzer Automation System Part I - Functional Specifications," and "The Continuous Flow Analyzer Automation System, Part II - User's Guide."

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FOREWORD

Environmental measurements are required to determine the quality of ambient waters and the character of waste effluents. The Environmental Monitoring and Support Laboratory - Cincinnati, conducts research to:

- Develop and evaluate techniques to measure the presence and concentration of physical, chemical, and radiological pollutants in water, wastewater, bottom sediments, and solid waste.
- Investigate methods for the concentration, recovery, and identification of viruses, bacteria and other microbiological organisms in water, and to determine the responses of aquatic organisms to water quality.
- Develop and operate an Agency-wide quality assurance program to assure standardization and quality control of systems for monitoring water and wastewater.
- Develop and operate a computerized system for instrument automation leading to improved data collection, analysis, and quality control.

This report was developed in the Advanced Instrumentation Section of the Environmental Monitoring and Support Laboratory in the interest of advancing laboratory techniques and quality control through computerization.

Robert L. Booth

Robert L. Booth
Acting Director
Environmental Monitoring and Support
Laboratory - Cincinnati

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ABSTRACT

This book contains complete documentation for the 21 programs and eight data files of the EPA Continuous Flow Analyzer Automation System. This system can receive lists of samples from the Sample File Control System and return the measured concentrations to that system. It is capable of interfacing with three continuous flow analyzer detectors simultaneously. It incorporates the following major features: 1) baseline interpolation between blanks, 2) multi-point calibration using first, second, or third degree regression or linear interpolation, 3) timely quality control assessments for spiked samples, duplicates, laboratory control standards, reagent blanks, and instrument check standards, 4) reagent blank subtraction, and 5) plotting of calibration curves and raw data peaks.

The programs of this system are written in Data General Extended BASIC, Revision 4.3, as enhanced for multi-user, real-time data acquisition. They run in a Data General Nova 840 minicomputer under the operating system RDOS, Revision 6.2.

In this document, there is a functional description, a symbol definitions table, a functional flowchart, a program listing, and a symbol cross reference table for each program. The structure of every data file is also detailed.

Two related publications are titled, "The Continuous Flow Analyzer Automation System, Part I -- Functional Specifications" and "The Continuous Flow Analyzer Automation System, Part II -- User's Guide."

This report was submitted in partial fulfillment of Task No. 80-07 of Contract No. GS-05S-10458 by the University of Cincinnati Computer Center under the sponsorship of the U.S. Environmental Protection Agency. It covers work done between December 17, 1979 and April 15, 1980.

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SECTION 1

INTRODUCTION

The Continuous Flow Analyzer Automation System is a set of programs which perform extensive processing of data from commercially available continuous flow analyzer instruments, namely those manufactured by the Technicon Corporation. The requirements and design of this system are published in the document "Functional Specifications for the Continuous Flow Analyzer Automation System,"[1] which should be read before this document. Another related publication is the "User's Guide for the Continuous Flow Analyzer Automation System."[2]

The Continuous Flow Analyzer (CFA) System is written in Data General Extended BASIC, Revision 4.3. It runs in a Data General Nova 840 minicomputer, under the Real-Time Disk Operating System (RDOS), Revision 6.2. The system consists of 21 programs, named CFA00 through CFA20. Figure 1 shows the main functions of each of the programs and their chaining relationships within the system.

Programs CFA07 and CFA08 employ calls to assembly language subroutines for real time data acquisition. These subroutines were written at the Lawrence Livermore Laboratory of the University of California, and they are extensively documented in the publication "Instrument Calls and Real-Time Code for Laboratory Automation"[3] by Louis Taber, et al.

Programs CFA03 and CFA17 deal with "run files" and "run results files" which are the means of transmitting data from and to the Sample File Control (SFC) System. That system is described in the document "Functional Specifications for the Sample File Control System in the Data General Nova 840,"[4] by Thomas Rose.

Programs CFA12, CFA19, and CFA20 incorporate general purpose plotting subroutines which are documented in the unpublished paper "Documentation for the BASIC Plotting Package,"[5] by the Advanced Instrumentation Section, Environmental Monitoring and Support Laboratory - Cincinnati.

In a document of a few hundred pages, it is impossible to explain every detail of over 6800 program statements. Therefore, for each of the 21 programs, this document contains only a brief functional description, a symbol definitions table, a functional flowchart, a program listing, and a symbol cross reference table. This document also includes descriptions of the structures of all of the files used by the system.

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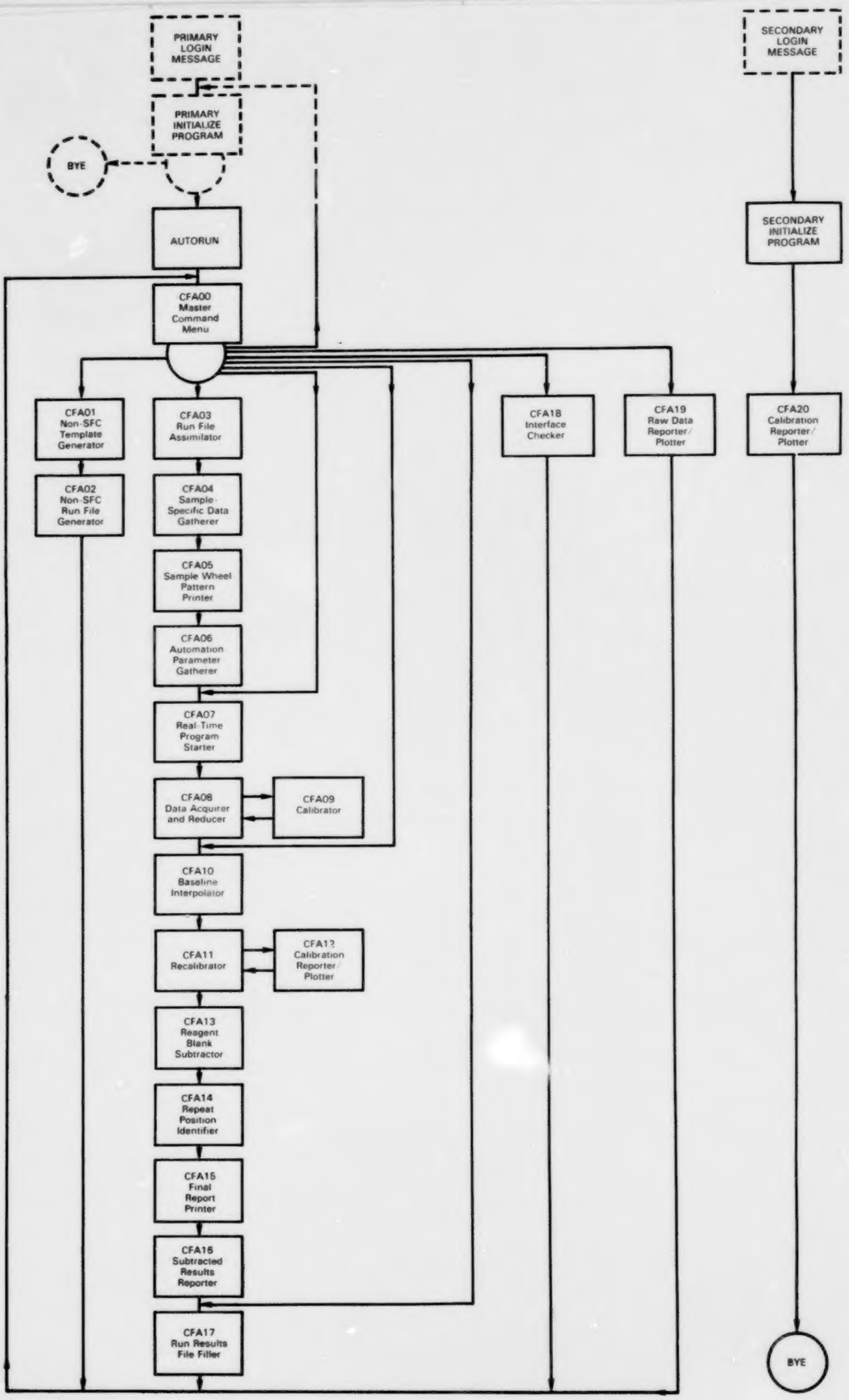
PRIMARY LOGIN MESSAGE
PRIMARY INITIALIZE PROGRAM
BYE
AUTORUN
CFA00 Master Command Menu
CFA01 Non-SFC Template Generator
CFA02 Non-SFC Run File Generator
CFA03 Run File Assimilator
CFA04 Sample-Specific Data Gatherer
CFA05 Sample Wheel Pattern Printer
CFA06 Automation Parameter Gatherer
CFA07 Real-Time Program Starter
CFA08 Data Acquirer and Reducer
CFA09 Calibrator
CFA10 Baseline Interpolator
CFA11 Recalibrator
CFA12 Calibration Reporter/Plotter
CFA13 Reagent Blank Subtractor
CFA14 Repeat Position Identifier
CFA15 Final Report Printer
CFA16 Subtracted Results Reporter
CFA17 Run Results File Filler
CFA18 Interface Checker
CFA19 Raw Data Reporter/Plotter
SECONDARY LOGIN MESSAGE
SECONDARY INITIALIZE PROGRAM
CFA20 Calibration Reporter/Plotter
BYE

Figure 1. Programs of the CFA System and their chaining relationships

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SECTION 2

PROGRAM CFA00 - MASTER COMMAND MENU

CFA00 is the master command menu of the Continuous Flow Analyzer Automation System. It is entered by chaining from the INITIALIZE program of the directory through the AUTORUN program of the directory.

This program simply displays the menu of major options available, asks the user for a choice, and then chains to the appropriate program.

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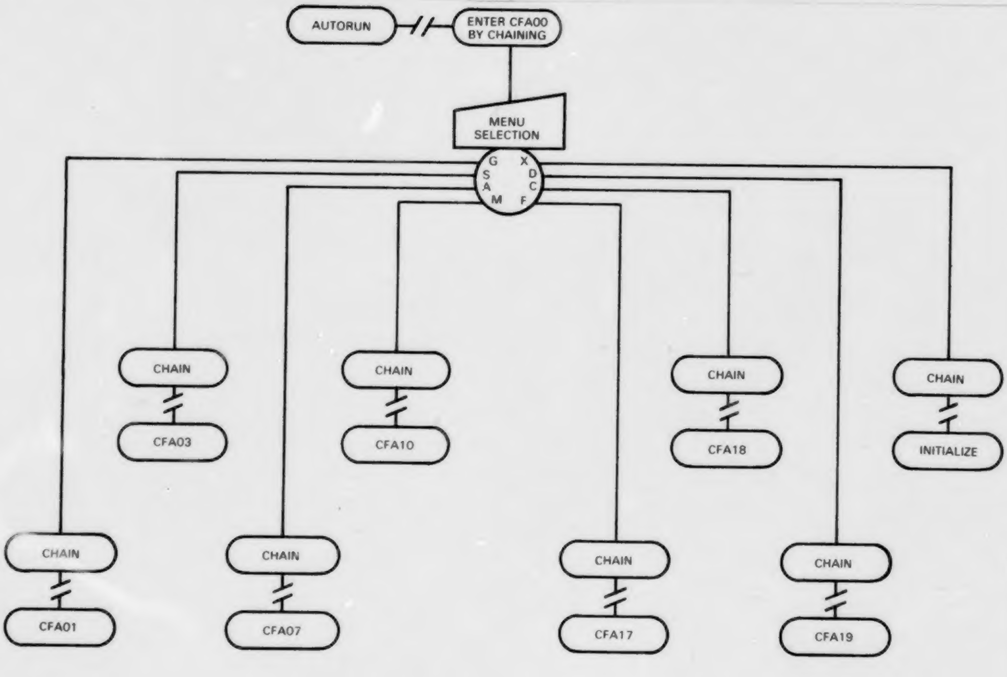
AUTORUN
ENTER CFA00 BY CHAINING
MENU SELECTION
G
S
A
M
X
D
C
F
CHAIN
CFA03
CHAIN
CFA10
CHAIN
CFA18
CHAIN
INITIALIZE
CHAIN
CFA01
CHAIN
CFA07
CHAIN
CFA17
CHAIN
CFA19

Figure 2 Functional Flowchart of Program CFA00

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TABLE 1. SYMBOL DEFINITIONS FOR CFA00

A$	the user's answer to the master command question

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C-O-N-T-I-N-U-O-U-S  F-L-O-W  A-N-A-L-Y-Z-E-R  A-U-T-O  S-Y-S-T-E-M
5/23/1980                                                  PAGE  1
                 PROGRAM LISTING FOR CFA00

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
0010 REM   +=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+
0020 REM   +   CONTINUOUS FLOW ANALYZER AUTOMATION SYSTEM            +
0030 REM   +   PROGRAM CFA00, CFA MASTER COMMAND MENU                 +
0040 REM   +   BY:  J. KOPKE (UCCC)      JANUARY 15, 1980            +
0050 REM   +   MOST RECENT REVISION:  APRIL 15, 1980                  +
0060 REM   +=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+
0070 REM
0080 DIM A$[1]
0090 ON ESC THEN GOTO 0280
0100 ESC
0110 GOTO 0280
0120 PRINT
0130 PRINT "H = HELP"
0140 PRINT "G = GENERATE A NON-SFC RUN FILE"
0150 PRINT "S = START OR RESTART AN AUTOMATED RUN FROM THE POINT OF AS
*    SIMILATING"
0160 PRINT "    A RUN FILE"
0170 PRINT "A = ACQUIRE RAW DATA:  RESTART AN AUTOMATED RUN FROM THE P
*    OINT OF"
0180 PRINT "    ESTABLISHING FULL SCALE AND BASELINE"
0190 PRINT "M = MANIPULATE DATA AND GET A FINAL REPORT FOR A BATCH WHI
*    CH HAS ALREADY"
0200 PRINT "    BEEN PROCESSED, OR FOR A BATCH WHICH HAS BEEN ABORTED"
0210 PRINT "F = FILL THE SFC RUN RESULTS FILE FOR A BATCH FOR WHICH A
*    FINAL"
0220 PRINT "    REPORT HAS BEEN PRINTED BUT FOR WHICH THE RUN RESULTS
*    FILE HAS NOT"
0230 PRINT "    BEEN FILLED PREVIOUSLY"
0240 PRINT "C = CHECK THE INTERFACE HARDWARE"
0250 PRINT "D = DISPLAY THE RAW DATA"
0260 PRINT "X = EXIT THE CFA AUTOMATION SYSTEM (THIS IS THE DEFAULT AN
*    SWER IF THERE"
0270 PRINT "    IS NO RESPONSE IN 10 MINUTES)"
0280 PRINT
0290 TIME =300
0300 ON ERR THEN GOTO 0350
0310 PRINT "CFA MASTER COMMAND ([H],G,S,A,M,F,C,D,X) >>  ";
0320 TINPUT "",A$
0330 ON ERR THEN STOP
0340 GOTO 0400
0350 ON ERR THEN STOP
0360 IF SYS(7)<>60 THEN GOTO 0400

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
```

```
C-O-N-T-I-N-U-O-U-S  F-L-O-W  A-N-A-L-Y-Z-E-R  A-U-T-O  S-Y-S-T-E-M
5/23/1980                                                  PAGE  2
                 PROGRAM LISTING FOR CFA00

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
0370 PRINT
0380 PRINT "NO RESPONSE IN 10 MINUTES HAS IMPLIED AN ANSWER OF 'X'"
0390 LET A$="X"
0400 IF A$="" THEN GOTO 0120
0410 IF A$="H" THEN GOTO 0120
0420 IF A$<>"G" THEN GOTO 0450
0430 NOESC
0440 CHAIN "CFA01"
0450 IF A$<>"S" THEN GOTO 0480
0460 NOESC
0470 CHAIN "CFA03"
0480 IF A$<>"A" THEN GOTO 0510
0490 NOESC
0500 CHAIN "CFA07"
0510 IF A$<>"M" THEN GOTO 0540
0520 NOESC
0530 CHAIN "CFA10"
0540 IF A$<>"F" THEN GOTO 0570
0550 NOESC
0560 CHAIN "CFA17"
0570 IF A$<>"C" THEN GOTO 0600
0580 NOESC
0590 CHAIN "CFA18"
0600 IF A$<>"D" THEN GOTO 0630
0610 NOESC
0620 CHAIN "CFA19"
0630 IF A$<>"X" THEN GOTO 0660
0640 NOESC
0650 CHAIN "INITIALIZE"
0660 PRINT
0670 PRINT "<7>INVALID RESPONSE"
0680 GOTO 0120

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
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C-O-N-T-I-N-U-O-U-S   F-L-O-W   A-N-A-L-Y-Z-E-R   A-U-T-O   S-Y-S-T-E-M
5/23/1980                                                          PAGE  3
                          SYMBOL TABLE FOR CFA00

SYMBOL    REFERENCES
------    ------------------------------------------------------------

 0120    0400  0410  0680
 0280    0090  0110
 0350    0300
 0400    0340  0360
 0450    0420
 0480    0450
 0510    0480
 0540    0510
 0570    0540
 0600    0570
 0630    0600
 0660    0630
 A$      0080  0320  0390  0400  0410  0420  0450  0480  0510  0540
         0570  0600  0630
```

SECTION 3

PROGRAM CFA01 - NON-SFC TEMPLATE GENERATOR

CFA01 is the program which generates and displays the calibration and sample templates which are then used in program CFA02 to build run files. CFA01 performs the functions of the Sample File Control (SFC) template programs for non-SFC users.

CFA01 is entered by chaining from CFA00, and it chains back to CFA00 if the ESCAPE key is pressed at any time during its execution.

The first time that this program is executed in a directory, it forces the user to generate a template file. On subsequent runs of the program, the user is first confronted with three options: 1) accept existing templates, 2) display existing templates, or 3) generate new templates.

If the user decides to accept the existing templates, the program simply chains to CFA02.

If the user decides to display the existing templates, the program copies the calibration template from the file CFA001, displays it on the terminal, copies the sample template from the same file, and displays it. The program then branches back to the original template options question.

If the user decides to generate new templates, the program asks for the number of analytes, the name of each analyte, the number of calibration standards, and the concentrations for all of the standards for each analyte. It uses all of this information to create the calibration template in file CFA001. The calibration template includes the three timing set standards, two blanks, and the calibration standards. The records are formatted exactly as they will appear in the run file.

Then the program allows the user to create a sample template. Unknowns, spiked samples, duplicates, blanks, laboratory control standards, check standards, and reagent blanks may be used in any order. If the user chooses to enter unknowns, the program asks how many consecutive unknowns should be placed into the template, and fills in the records appropriately. A similar feature is implemented for blanks.

If the user chooses to have a spike in the sample template, the program asks for the template position of the associated unknown. The program checks to be sure that the specified position is really an unknown, and then enters the records for the spike into the template. Similarly, if the user chooses to have a duplicate in the template, the program asks for the template position of the associated unknown, checks to be sure that the specified position is an unknown, and then determines whether the duplicate is an LD2, LD3, . . . LD8, or LD9 before entering the record into the template.

If the user chooses to place a laboratory control standard into the template, the program asks for the theoretical concentration of each analyte and then places the records into the template. Similarly, if the user chooses to include a check standard, the program asks for the theoretical concentration of the standard, and then checks to be sure that the specified concentration is the same as that of one of the calibration standards before placing the records into the template.

Reagent blanks are placed into the template with no input from the user other than to specify their inclusion.

The template file, CFA001, is different from the run file in two significant ways, both of which are designed to make the template file have the same number of records for every sample template position. First, blanks and check standards in the template file are preceded by a "type 9" null record which makes up for the fact that blanks and check standards do not have "type 6" records. Secondly, the LSA records for spikes and the LCM records for laboratory control standards are left out of the template file. They are generated and inserted into the run file by CFA02.

After the sample template is complete, the program returns to the original template options question.

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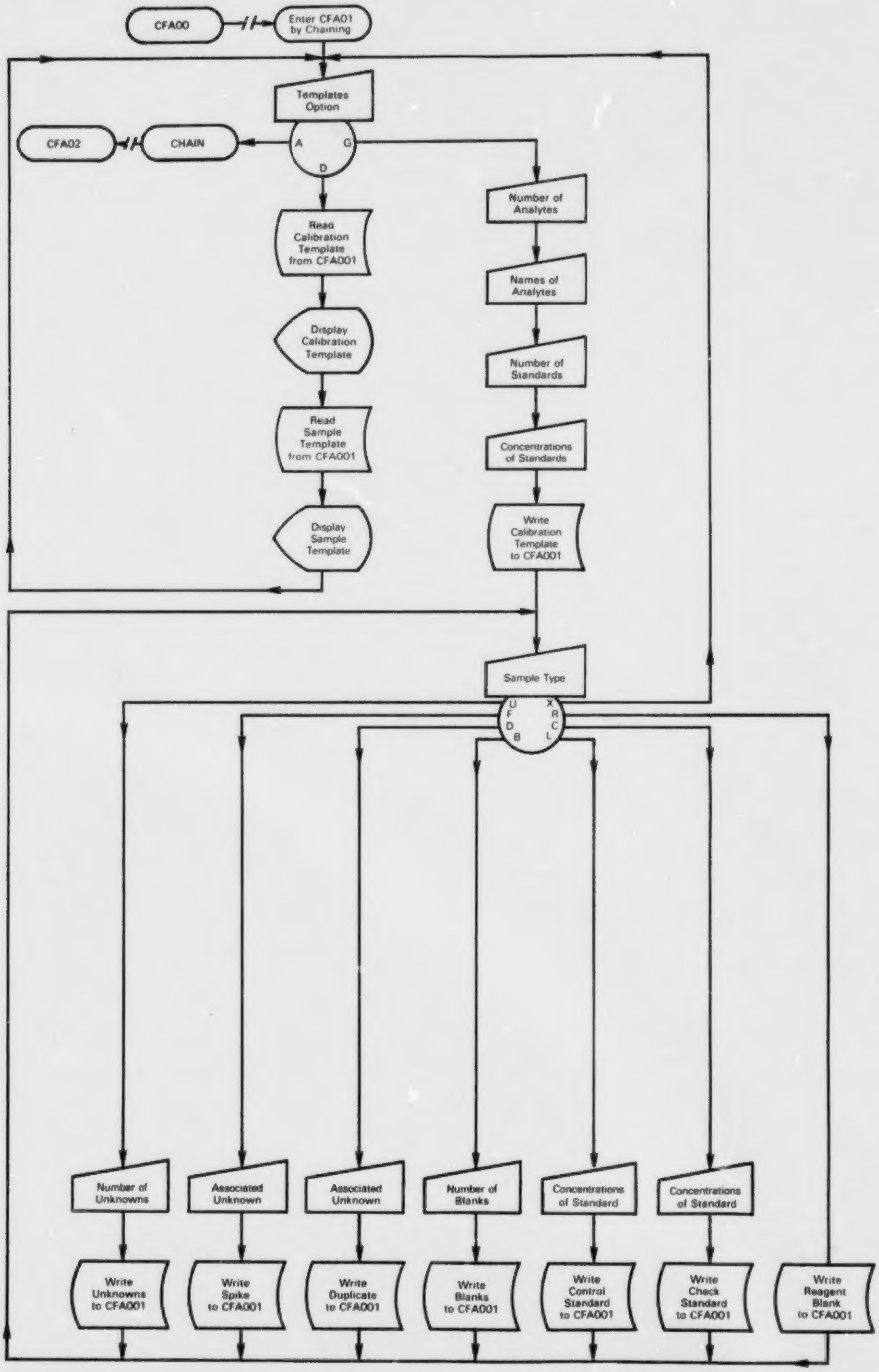
CFA00
Enter CFA01 by Chaining
Templates Option
A
G
D
CFA02
CHAIN
Read Calibration Template from CFA001
Display Calibration Template
Read Sample Template from CFA001
Display Sample Template
Number of Analytes
Names of Analytes
Number of Standards
Concentrations of Standards
Write Calibration Template to CFA001
Sample Type
U
F
D
B
X
R
C
L
Number of Unknowns
Associated Unknown
Associated Unknown
Number of Blanks
Concentrations of Standard
Concentrations of Standard
Write Unknowns to CFA001
Write Spike to CFA001
Write Duplicate to CFA001
Write Blanks to CFA001
Write Control Standard to CFA001
Write Check Standard to CFA001
Write Reagent Blank to CFA001

Figure 3. Functional Flowchart of Program CFA01

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TABLE 2. SYMBOL DEFINITIONS FOR PROGRAM CFA01

A$	the user's answer to most questions
A1$	the superstring containing the names of the analytes
A2$	the superstring of the three dummy parameter-method codes
A3$	a multi-purpose string of formatted data
A4$	the multi-analyte dummy record
A()	the array of known concentrations of calibration standards
D9	the counter which becomes the appropriate third character of LD2, LD3, LD4, etc.
E	the exponent for a number in scientific notation
I	the control variable for loops
J	the control variable for loops
N	the number of analytes
N$	a number in scientific notation as a string
N1	the number of calibration standards
N1$	part of a number being transformed into scientific notation
N3	the number of positions in the sample template
N4	the number of consecutive unknowns or blanks
N5	the template position of the unknown corresponding to a spike or duplicate
N9	the number of positions for unknowns in the sample template
R	the number of the next record to be written into
R2	the number of the last record of the calibration template
X	a number being passed to the subroutine to be converted into scientific notation

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PAGE NUMBER

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C-O-N-T-I-N-U-O-U-S  F-L-O-W  A-N-A-L-Y-Z-E-R  A-U-T-O  S-Y-S-T-E-M
5/23/1980                                                   PAGE  1
                   PROGRAM LISTING FOR CFA01

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
0010 REM   +=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+
0020 REM   +   CONTINUOUS FLOW ANALYZER AUTOMATION SYSTEM              +
0030 REM   +   PROGRAM CFA01, NON-SFC TEMPLATE GENERATOR               +
0040 REM   +   BY:  J. KOPKE (UCCC)      JANUARY 8, 1980              +
0050 REM   +   MOST RECENT REVISION:  APRIL 15, 1980                   +
0060 REM   +=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+
0070 REM
0080 DIM A$[9],A1$[21],A2$[21],A3$[79],A4$[79],A[3,20],N$[10],N1$[10]
0090 ON ESC THEN GOTO 0110
0100 GOTO 0140
0110 NOESC
0120 CLOSE
0130 CHAIN "CFA00"
0140 ESC
0150 REM   _____________________________________________________________
0160 REM            RUN FILE GENERATOR MASTER QUESTION
0170 ON ERR THEN GOTO 0190
0180 RENAME "CFA001","CFA001"
0190 ON ERR THEN STOP
0200 IF SYS(7)=-10 THEN GOTO 1530
0210 GOTO 0270
0220 PRINT
0230 PRINT "H = HELP"
0240 PRINT "A = ACCEPT EXISTING TEMPLATES"
0250 PRINT "D = DISPLAY EXISTING TEMPLATES"
0260 PRINT "G = GENERATE NEW TEMPLATES"
0270 PRINT
0280 ON ERR THEN GOTO 0300
0290 INPUT "TEMPLATES ([H],A,D,G) >>  ",A$
0300 ON ERR THEN STOP
0310 IF A$="" THEN GOTO 0220
0320 IF A$="H" THEN GOTO 0220
0330 IF A$="A" THEN GOTO 5480
0340 IF A$="D" THEN GOTO 0410
0350 IF A$="G" THEN GOTO 1530
0360 PRINT
0370 PRINT "<7>INVALID RESPONSE"
0380 GOTO 0220
0390 REM   _____________________________________________________________
0400 REM             DISPLAY TEMPLATES
0410 OPEN FILE[0,0],"CFA001",80
0420 READ FILE[0,0],N,A1$,N1,N3

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
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```
C-O-N-T-I-N-U-O-U-S  F-L-O-W  A-N-A-L-Y-Z-E-R  A-U-T-O  S-Y-S-T-E-M
5/23/1980                                                   PAGE  2
                   PROGRAM LISTING FOR CFA01

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
0430 PRINT
0440 PRINT
0450 PRINT
0460 PRINT
0470 PRINT
0480 PRINT  TAB(17);"C-A-L-I-B-R-A-T-I-O-N  T-E-M-P-L-A-T-E"
0490 PRINT
0500 PRINT " TEMPLATE       SAMPLE                    ";
0510 FOR I=1 TO N
0520   PRINT "     ";A1$[I*7-6,I*7];
0530 NEXT I
0540 PRINT
0550 PRINT " POSITION        TYPE                     ";
0560 FOR I=1 TO N
0570   PRINT "   RESULTS ";
0580 NEXT I
0590 PRINT
0600 PRINT "_________   ___________                   ";
0610 FOR I=1 TO N
0620   PRINT "   _______";
0630 NEXT I
0640 PRINT
0650 PRINT "001            SET STND"
0660 PRINT "002            SET STND"
0670 PRINT "003            SET STND"
0680 PRINT "004            BLANK"
0690 PRINT "005            BLANK"
0700 FOR I=1 TO N1
0710   LET A3$="000"
0720   LET A3$[4-LEN(STR$(I+5)),3]=STR$(I+5)
0730   PRINT A3$;"         CAL STND              TCONC:";
0740   FOR J=1 TO N
0750     READ FILE[0,5*N+(I-1)*N+J],A3$
0760     PRINT USING " ----#.###",VAL(A3$[5,14]);
0770     PRINT " ";
0780   NEXT J
0790   PRINT
0800 NEXT I
0810 PRINT
0820 PRINT
0830 PRINT
0840 PRINT

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
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```
C-O-N-T-I-N-U-O-U-S   F-L-O-W   A-N-A-L-Y-Z-E-R   A-U-T-O   S-Y-S-T-E-M
5/23/1980                                                          PAGE  3
                    PROGRAM LISTING FOR CFA01

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
0850 PRINT
0860 PRINT  TAB(22);"S-A-M-P-L-E   T-E-M-P-L-A-T-E"
0870 PRINT
0880 PRINT " TEMPLATE       SAMPLE                         ";
0890 FOR I=1 TO N
0900   PRINT "    ";A1$[I*7-6,I*7];
0910 NEXT I
0920 PRINT
0930 PRINT " POSITION        TYPE                          ";
0940 FOR I=1 TO N
0950   PRINT "   RESULTS ";
0960 NEXT I
0970 PRINT
0980 PRINT "___________  ___________                       ";
0990 FOR I=1 TO N
1000   PRINT "  ________";
1010 NEXT I
1020 PRINT
1030 FOR I=1 TO N3
1040   LET A3$="000"
1050   LET A3$[4-LEN(STR$(I)),3]=STR$(I)
1060   PRINT A3$;"          ";
1070   READ FILE[0,N*(5+N1)+(N+1)*(I-1)+2],A3$
1080   IF A3$[1,1]<>"3" THEN GOTO 1200
1090   IF A3$[39,39]<>"B" THEN GOTO 1120
1100   PRINT "BLANK"
1110   GOTO 1430
1120   PRINT "CHECK STND                    CONC:";
1130   FOR J=1 TO N
1140     READ FILE[0,N*(5+N1)+(N+1)*(I-1)+J+1],A3$
1150     PRINT USING " ----#.###",VAL(A3$[5,14]);
1160     PRINT " ";
1170   NEXT J
1180   PRINT
1190   GOTO 1430
1200   IF A3$[12,14]="   " THEN GOTO 1250
1210   IF A3$[12,14]="LSO" THEN GOTO 1250
1220   IF A3$[12,14]="LD1" THEN GOTO 1250
1230   IF A3$[12,14]="LDX" THEN GOTO 1250
1240   GOTO 1270
1250   PRINT "UNKNOWN"
1260   GOTO 1430

123456789112.    7212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
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C-O-N-T-I-N-U-O-U-S   F-L-O-W   A-N-A-L-Y-Z-E-R   A-U-T-O   S-Y-S-T-E-M
5/23/1980                                                          PAGE  4
                    PROGRAM LISTING FOR CFA01

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
1270   IF A3$[12,14]<>"LSF" THEN GOTO 1300
1280   PRINT "SPIKE OF ";A3$[8,10]
1290   GOTO 1430
1300   IF A3$[12,14]<>"LRB" THEN GOTO 1330
1310   PRINT "REAGENT BLNK"
1320   GOTO 1430
1330   IF A3$[12,14]<>"LCT" THEN GOTO 1420
1340   PRINT "CONTROL STND                   LCT:";
1350   FOR J=1 TO N
1360     READ FILE[0,N*(5+N1)+(N+1)*(I-1)+J+1],A3$
1370     PRINT USING " ----#.###",VAL(A3$[28,37]);
1380     PRINT " ";
1390   NEXT J
1400   PRINT
1410   GOTO 1430
1420   PRINT "DUPE  OF ";A3$[8,10]
1430 NEXT I
1440 PRINT
1450 PRINT
1460 PRINT
1470 PRINT
1480 PRINT
1490 CLOSE FILE[0]
1500 GOTO 0270
1510 REM   ____________________________________________________________
1520 REM              TEMPLATE HOUSKEEPING
1530 ON ERR THEN GOTO 1550
1540 DELETE "CFA001"
1550 ON ERR THEN STOP
1560 OPEN FILE[0,0],"CFA001",80
1570 ON ESC THEN GOTO 1590
1580 GOTO 1690
1590 NOESC
1600 CLOSE
1610 ON ERR THEN GOTO 1630
1620 DELETE "CFA001"
1630 ON ERR THEN STOP
1640 PRINT
1650 PRINT "<7>ALL TEMPLATES HAVE BEEN DELETED BECAUSE THEY WERE INCOM
*    PLETE"
1660 CHAIN "CFA00"
1670 REM   ____________________________________________________________

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
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EPA-287 (Cin.)
(4-76)

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C-O-N-T-I-N-U-O-U-S   F-L-O-W   A-N-A-L-Y-Z-E-R   A-U-T-O   S-Y-S-T-E-M
5/23/1980                                                          PAGE  5
                        PROGRAM LISTING FOR CFA01

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
1680 REM          GENERATE CALIBRATION TEMPLATE
1690 PRINT
1700 ON ERR THEN GOTO 1720
1710 INPUT "NUMBER OF ANALYTES ([1],2,3) >>  ",A$
1720 ON ERR THEN STOP
1730 IF A$<>"" THEN GOTO 1760
1740 LET N=1
1750 GOTO 1840
1760 LET N=0
1770 ON ERR THEN GOTO 1790
1780 LET N=VAL(A$)
1790 ON ERR THEN STOP
1800 IF N=INT(N) THEN IF N>0 THEN IF N<4 THEN GOTO 1840
1810 PRINT
1820 PRINT "<7>INVALID RESPONSE"
1830 GOTO 1690
1840 LET A1$=""
1850 PRINT
1860 FOR I=1 TO N
1870   PRINT "NAME OF ";
1880   IF N=1 THEN GOTO 1920
1890   IF I=1 THEN PRINT "FIRST ";
1900   IF I=2 THEN PRINT "SECOND ";
1910   IF I=3 THEN PRINT "THIRD ";
1920   ON ERR THEN GOTO 1940
1930   INPUT "ANALYTE >>  ",A$
1940   ON ERR THEN STOP
1950   IF A$<>"" THEN GOTO 2000
1960   PRINT
1970   PRINT "<7>INVALID RESPONSE"
1980   PRINT
1990   GOTO 1870
2000   IF LEN(A$)<=7 THEN GOTO 2050
2010   PRINT
2020   PRINT "<7>INVALID RESPONSE;  LIMIT OF SEVEN CHARACTERS EXCEEDED
*      "
2030   PRINT
2040   GOTO 1870
2050   IF LEN(A$)=7 THEN GOTO 2080
2060   LET A$=A$," "
2070   GOTO 2050
2080   LET A1$=A1$,A$

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
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C-O-N-T-I-N-U-O-U-S   F-L-O-W   A-N-A-L-Y-Z-E-R   A-U-T-O   S-Y-S-T-E-M
5/23/1980                                                          PAGE  6
                        PROGRAM LISTING FOR CFA01

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
2090 NEXT I
2100 PRINT
2110 ON ERR THEN GOTO 2130
2120 INPUT "NUMBER OF CALIBRATION STANDARDS >>  ",N1
2130 ON ERR THEN STOP
2140 IF N1=INT(N1) THEN IF N1>0 THEN IF N1<21 THEN GOTO 2180
2150 PRINT
2160 PRINT "<7>INVALID RESPONSE"
2170 GOTO 2100
2180 LET A2$=A1$
2190 LET R=1
2200 FOR I=1 TO 3
2210   FOR J=1 TO N
2220     LET A3$="3                P   ",A2$[7*J-6,7*J],"            T
*                                            "
2230     WRITE FILE[0,R],A3$
2240     LET R=R+1
2250   NEXT J
2260 NEXT I
2270 FOR I=1 TO 2
2280   FOR J=1 TO N
2290     LET A3$="3                P   ",A2$[7*J-6,7*J],"            B
*                                            "
2300     WRITE FILE[0,R],A3$
2310     LET R=R+1
2320   NEXT J
2330 NEXT I
2340 FOR I=1 TO N
2350   PRINT
2360   PRINT "CONCENTRATIONS IN DEFAULT UNITS FOR STANDARDS FOR ";A1$[
*      I*7-6,I*7];":"
2370   FOR J=1 TO N1
2380     PRINT USING "     STANDARD ## >>  ",J;
2390     ON ERR THEN GOTO 2410
2400     INPUT "",A[I,J]
2410     ON ERR THEN STOP
2420   NEXT J
2430 NEXT I
2440 FOR I=1 TO N1
2450   FOR J=1 TO N
2460     LET X=A[J,I]
2470     GOSUB 5520

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
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C-O-N-T-I-N-U-O-U-S   F-L-O-W   A-N-A-L-Y-Z-E-R   A-U-T-O   S-Y-S-T-E-M
5/23/1980                                                          PAGE  7
                    PROGRAM LISTING FOR CFA01

12345678911234567892123456789312345678941234567895123456789612345678 97
         0         0         0         0         0         0         0
 2480       LET A3$="3   ",N$," P   ",A2$[7*J-6,7*J],"          S
*
 2490       WRITE FILE[0,R],A3$
 2500       LET R=R+1
 2510     NEXT J
 2520 NEXT I
 2530 REM    ________________________________________________________
 2540 REM           SAMPLE TEMPLATE MASTER QUESTION
 2550 LET N3=0
 2560 LET N9=0
 2570 LET R2=R-1
 2580 LET A4$="6             000 P   000YZNN
*
 2590 LET A4$[14,14]=STR$(N)
 2600 PRINT
 2610 PRINT "GENERATE SAMPLE TEMPLATE USING [H],U,F,D,B,L,C,R,X"
 2620 GOTO 2740
 2630 PRINT
 2640 PRINT
 2650 PRINT "H = HELP"
 2660 PRINT "U = UNKNOWN"
 2670 PRINT "F = SPIKED SAMPLE"
 2680 PRINT "D = DUPLICATE"
 2690 PRINT "B = BLANK"
 2700 PRINT "L = LABORATORY CONTROL STANDARD"
 2710 PRINT "C = CHECK STANDARD"
 2720 PRINT "R = REAGENT BLANK"
 2730 PRINT "X = END OF TEMPLATE"
 2740 PRINT
 2750 IF N3<200 THEN GOTO 2790
 2760 PRINT
 2770 PRINT "<7>THE LIMIT OF 200 SAMPLE TEMPLATE POSITIONS HAS BEEN REA
*     CHED"
 2780 GOTO 5410
 2790 PRINT USING "POSITION###",N3+1;
 2800 ON ERR THEN GOTO 2820
 2810 INPUT " >>  ",A$;
 2820 ON ERR THEN STOP
 2830 IF A$="" THEN GOTO 2630
 2840 IF A$="H" THEN GOTO 2630
 2850 IF A$="U" THEN GOTO 2990
 2860 IF A$="F" THEN GOTO 3340

12345678911234567892123456789312345678941234567895123456789612345678 97
         0         0         0         0         0         0         0
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C-O-N-T-I-N-U-O-U-S   F-L-O-W   A-N-A-L-Y-Z-E-R   A-U-T-O   S-Y-S-T-E-M
5/23/1980                                                          PAGE  8
                    PROGRAM LISTING FOR CFA01

12345678911234567892123456789312345678941234567895123456789612345678 97
         0         0         0         0         0         0         0
2870 IF A$="D" THEN GOTO 3820
2880 IF A$="B" THEN GOTO 4440
2890 IF A$="L" THEN GOTO 4790
2900 IF A$="C" THEN GOTO 4970
2910 IF A$="R" THEN GOTO 5290
2920 IF A$="X" THEN GOTO 5410
2930 PRINT
2940 PRINT
2950 PRINT "<7>INVALID RESPONSE"
2960 GOTO 2640
2970 REM    ________________________________________________________
2980 REM           PLACE UNKNOWNS IN SAMPLE TEMPLATE
2990 PRINT  TAB(22);
3000 ON ERR THEN GOTO 3020
3010 INPUT "NUMBER OF CONSECUTIVE UNKNOWNS ([1],---) >>  ",A$
3020 ON ERR THEN STOP
3030 IF A$="" THEN GOTO 3090
3040 LET N4=-99999
3050 ON ERR THEN GOTO 3070
3060 LET N4=VAL(A$)
3070 ON ERR THEN STOP
3080 GOTO 3100
3090 LET N4=1
3100 IF N4=ABS(INT(N4)) THEN GOTO 3160
3110 PRINT
3120 PRINT "<7>                             INVALID RESPONSE"
3130 PRINT
3140 PRINT  TAB(23);
3150 GOTO 2990
3160 FOR I=N3+2 TO N3+N4
3170   PRINT USING "POSITION###     U",I
3180 NEXT I
3190 FOR I=1 TO N4
3200   WRITE FILE[0,R],A4$
3210   LET R=R+1
3220   LET N9=N9+1
3230   FOR J=1 TO N
3240     LET A3$="2                    P   ",A2$[7*J-6,7*J],"          ?G/
*     L
3250     WRITE FILE[0,R],A3$
3260     LET R=R+1
3270   NEXT J

12345678911234567892123456789312345678941234567895123456789612345678 97
         0         0         0         0         0         0         0
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C-O-N-T-I-N-U-O-U-S  F-L-O-W  A-N-A-L-Y-Z-E-R  A-U-T-O   S-Y-S-T-E-M
5/23/1980                                                    PAGE  9
                   PROGRAM LISTING FOR CFA01

123456789112345678921234567893123456789412345678951234567896123456789 7
         0         0         0         0         0         0         0
3280   LET N3=N3+1
3290   IF N3=200 THEN GOTO 2760
3300 NEXT I
3310 GOTO 2750
3320 REM ----------------------------------------------------------
3330 REM           PLACE SPIKE IN SAMPLE TEMPLATE
3340 PRINT  TAB(22);
3350 ON ERR THEN GOTO 3370
3360 INPUT "POSITION OF CORRESPONDING UNKNOWN >>  ",N5
3370 ON ERR THEN STOP
3380 IF N5<>INT(ABS(N5)) THEN GOTO 3420
3390 IF N5>N3 THEN GOTO 3420
3400 IF N5=0 THEN GOTO 3420
3410 GOTO 3470
3420 PRINT
3430 PRINT "<7>                          INVALID RESPONSE"
3440 PRINT
3450 PRINT  TAB(23);
3460 GOTO 3350
3470 READ FILE[0,R2+(N5-1)*(N+1)+2],A3$
3480 IF A3$[1,1]<>"2" THEN GOTO 3650
3490 IF A3$[12,14]<>"   " THEN GOTO 3560
3500 FOR I=1 TO N
3510   READ FILE[0,R2+(N5-1)*(N+1)+I+1],A3$
3520   LET A3$[12,14]="LSO"
3530   WRITE FILE[0,R2+(N5-1)*(N+1)+I+1],A3$
3540 NEXT I
3550 GOTO 3700
3560 IF A3$[12,14]="LSO" THEN GOTO 3700
3570 IF A3$[12,14]<>"LD1" THEN GOTO 3640
3580 FOR I=1 TO N
3590   READ FILE[0,R2+(N5-1)*(N+1)+I+1],A3$
3600   LET A3$[12,14]="LDX"
3610   WRITE FILE[0,R2+(N5-1)*(N+1)+I+1],A3$
3620 NEXT I
3630 GOTO 3700
3640 IF A3$[12,14]="LDX" THEN GOTO 3700
3650 PRINT
3660 PRINT USING "<7>                              POSITION## IS NOT AN UNKN
*     OWN;",N5
3670 PRINT USING "                             RE-ENTER CHOICE FOR POSITION#
*     ##",N3+1

123456789112345678921234567893123456789412345678951234567896123456789 7
         0         0         0         0         0         0         0
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C-O-N-T-I-N-U-O-U-S  F-L-O-W  A-N-A-L-Y-Z-E-R  A-U-T-O   S-Y-S-T-E-M
5/23/1980                                                    PAGE 10
                   PROGRAM LISTING FOR CFA01

123456789112345678921234567893123456789412345678951234567896123456789 7
         0         0         0         0         0         0         0
3680 PRINT
3690 GOTO 2750
3700 WRITE FILE[0,R],A4$
3710 LET R=R+1
3720 FOR J=1 TO N
3730   LET A3$="2 00000000 LSF P   ",A2$[7*J-6,7*J],"             ?G/L
*
3740   LET A3$[11-LEN(STR$(N5)),10]=STR$(N5)
3750   WRITE FILE[0,R],A3$
3760   LET R=R+1
3770 NEXT J
3780 LET N3=N3+1
3790 GOTO 2750
3800 REM ----------------------------------------------------------
3810 REM           PLACE DUPLICATE INTO SAMPLE TEMPLATE
3820 PRINT  TAB(22);
3830 ON ERR THEN GOTO 3850
3840 INPUT "POSITION OF CORRESPONDING UNKNOWN >>  ",N5
3850 ON ERR THEN STOP
3860 IF N5<>INT(ABS(N5)) THEN GOTO 3900
3870 IF N5>N3 THEN GOTO 3900
3880 IF N5=0 THEN GOTO 3900
3890 GOTO 3950
3900 PRINT
3910 PRINT "<7>                          INVALID RESPONSE"
3920 PRINT
3930 PRINT  TAB(23);
3940 GOTO 3830
3950 READ FILE[0,R2+(N5-1)*(N+1)+2],A3$
3960 IF A3$[1,1]<>"2" THEN GOTO 3650
3970 IF A3$[12,14]<>"   " THEN GOTO 4040
3980 FOR I=1 TO N
3990   READ FILE[0,R2+(N5-1)*(N+1)+I+1],A3$
4000   LET A3$[12,14]="LD1"
4010   WRITE FILE[0,R2+(N5-1)*(N+1)+I+1],A3$
4020 NEXT I
4030 GOTO 4140
4040 IF A3$[12,14]<>"LSO" THEN GOTO 4110
4050 FOR I=1 TO N
4060   READ FILE[0,R2+(N5-1)*(N+1)+I+1],A3$
4070   LET A3$[12,14]="LDX"
4080   WRITE FILE[0,R2+(N5-1)*(N+1)+I+1],A3$

123456789112345678921234567893123456789412345678951234567896123456789 7
         0         0         0         0         0         0         0
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BOTTOM OF IMAGE AREA; OUTSIDE DIMENSION FOR TABLES AND ILLUSTRATIONS
EPA-287 (Cin.)
(4-76)

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C-O-N-T-I-N-U-O-U-S   F-L-O-W   A-N-A-L-Y-Z-E-R   A-U-T-O   S-Y-S-T-E-M
5/23/1980                                                          PAGE 11
                       PROGRAM LISTING FOR CFA01

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
4090 NEXT I
4100 GOTO 4140
4110 IF A3$[12,14]="LD1" THEN GOTO 4140
4120 IF A3$[12,14]="LDX" THEN GOTO 4140
4130 GOTO 3650
4140 LET D9=2
4150 FOR I=N5 TO N3-1
4160   READ FILE[0,R2+I*(N+1)+2],A3$
4170   IF A3$[1,1]<>"2" THEN GOTO 4230
4180   IF A3$[12,13]<>"LD" THEN GOTO 4230
4190   IF A3$[12,14]="LD1" THEN GOTO 4230
4200   IF A3$[12,14]="LDX" THEN GOTO 4230
4210   IF VAL(A3$[3,10])<>N5 THEN GOTO 4230
4220   LET D9=D9+1
4230 NEXT I
4240 IF D9<10 THEN GOTO 4310
4250 PRINT
4260 PRINT "<7>                             THERE ARE ALREADY 8 DUPLICATES F
*    OR THE"
4270 PRINT USING "                              UNKNOWN IN POSITION###;",N5
4280 PRINT USING "                              RE-ENTER CHOICE FOR POSITION#
*    ##",N3+1
4290 PRINT
4300 GOTO 2750
4310 WRITE FILE[0,R],A4$
4320 LET R=R+1
4330 FOR J=1 TO N
4340   LET A3$="2 00000000 LD2 P   ",A2$[7*J-6,7*J],"              ?G/L
*
4350   LET A3$[11-LEN(STR$(N5)),10]=STR$(N5)
4360   LET A3$[14,14]=STR$(D9)
4370   WRITE FILE[0,R],A3$
4380   LET R=R+1
4390 NEXT J
4400 LET N3=N3+1
4410 GOTO 2750
4420 REM  ----------------------------------------------------------------
4430 REM          PLACE BLANKS INTO SAMPLE TEMPLATE
4440 PRINT  TAB(22);
4450 ON ERR THEN GOTO 4470
4460 INPUT "NUMBER OF CONSECUTIVE BLANKS ([1],---) >>  ",A$
4470 ON ERR THEN STOP

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
```

```
C-O-N-T-I-N-U-O-U-S   F-L-O-W   A-N-A-L-Y-Z-E-R   A-U-T-O   S-Y-S-T-E-M
5/23/1980                                                          PAGE 12
                       PROGRAM LISTING FOR CFA01

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
4480 IF A$="" THEN GOTO 4540
4490 LET N4=-99999
4500 ON ERR THEN GOTO 4520
4510 LET N4=VAL(A$)
4520 ON ERR THEN STOP
4530 GOTO 4550
4540 LET N4=1
4550 IF N4=ABS(INT(N4)) THEN IF N4>0 THEN GOTO 4610
4560 PRINT
4570 PRINT "<7>                             INVALID RESPONSE"
4580 PRINT
4590 PRINT  TAB(23);
4600 GOTO 4450
4610 FOR I=N3+2 TO N3+N4
4620   PRINT USING "POSITION###     B",I
4630 NEXT I
4640 FOR I=1 TO N4
4650   LET A3$="9
*
4660   WRITE FILE[0,R],A3$
4670   LET R=R+1
4680   FOR J=1 TO N
4690     LET A3$="3                  P   ",A2$[7*J-6,7*J],"          B
*
4700     WRITE FILE[0,R],A3$
4710     LET R=R+1
4720   NEXT J
4730   LET N3=N3+1
4740   IF N3=200 THEN GOTO 2760
4750 NEXT I
4760 GOTO 2750
4770 REM  ----------------------------------------------------------------
4780 REM          PLACE LAB CONTROL STANDARD INTO SAMPLE TEMPLATE
4790 WRITE FILE[0,R],A4$
4800 LET R=R+1
4810 FOR I=1 TO N
4820   PRINT  TAB(22);
4830   IF I<>1 THEN PRINT " ";
4840   PRINT "CONCENTRATION IN DEFAULT UNITS FOR ";A1$[I*7-6,I*7];
4850   ON ERR THEN GOTO 4870
4860   INPUT " >>  ",X
4870   ON ERR THEN STOP

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
```

EPA-287 (Cin.)
(4-76)

```
C-O-N-T-I-N-U-O-U-S  F-L-O-W  A-N-A-L-Y-Z-E-R  A-U-T-O  S-Y-S-T-E-M
5/23/1980                                                     PAGE 13
                      PROGRAM LISTING FOR CFA01

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0       0
4880  GOSUB 5520
4890  LET A3$="2          LCT P   ",A2$[7*I-6,7*I]," ",N$," ?G/L
#                                      "
4900  WRITE FILE[0,R],A3$
4910  LET R=R+1
4920 NEXT I
4930 LET N3=N3+1
4940 GOTO 2750
4950 REM ----------------------------------------------------------
4960 REM          PLACE CHECK STANDARD INTO SAMPLE TEMPLATE
4970 LET A3$="9
#                         "
4980 WRITE FILE[0,R],A3$
4990 LET R=R+1
5000 FOR I=1 TO N
5010   PRINT  TAB(22);
5020   IF I<>1 THEN PRINT " ";
5030   PRINT "CONCENTRATION IN DEFAULT UNITS FOR ";A1$[I*7-6,I*7];
5040   IF I=1 THEN GOTO 5080
5050   PRINT "     ";A[I,J]
5060   LET X=A[I,J]
5070   GOTO 5200
5080   ON ERR THEN GOTO 5100
5090   INPUT " >> ",X
5100   ON ERR THEN STOP
5110   FOR J=1 TO N1
5120     IF X=A[I,J] THEN GOTO 5200
5130   NEXT J
5140   PRINT
5150   PRINT "<7>                       THERE IS NO CALIBRATION STANDA
#   RD WITH"
5160   PRINT "                        THAT CONCENTRATION;  RE-ENTER THE
#    VALUE"
5170   PRINT
5180   PRINT  TAB(23);
5190   GOTO 5030
5200   GOSUB 5520
5210   LET A3$="3   ",N$," P   ",A2$[7*I-6,7*I],"          CS
#                                      "
5220   WRITE FILE[0,R],A3$
5230   LET R=R+1
5240 NEXT I

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0       0
```

```
C-O-N-T-I-N-U-O-U-S  F-L-O-W  A-N-A-L-Y-Z-E-R  A-U-T-O  S-Y-S-T-E-M
5/23/1980                                                     PAGE 14
                      PROGRAM LISTING FOR CFA01

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0       0
5250 LET N3=N3+1
5260 GOTO 2750
5270 REM ----------------------------------------------------------
5280 REM          PLACE REAGENT BLANK INTO SAMPLE TEMPLATE
5290 PRINT
5300 WRITE FILE[0,R],A4$
5310 LET R=R+1
5320 FOR I=1 TO N
5330   LET A3$="2          LRB P   ",A2$[7*I-6,7*I],"          ?G/L
#                                      "
5340   WRITE FILE[0,R],A3$
5350   LET R=R+1
5360 NEXT I
5370 LET N3=N3+1
5380 GOTO 2750
5390 REM ----------------------------------------------------------
5400 REM          END OF SAMPLE TEMPLATE
5410 PRINT
5420 WRITE FILE[0,0],N,A1$,N1,N3,N9
5430 CLOSE FILE[0]
5440 ON ESC THEN GOTO 0110
5450 GOTO 0270
5460 REM ----------------------------------------------------------
5470 REM          CHAIN TO CFA01
5480 NOESC
5490 CHAIN "CFA02"
5500 REM  ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
5510 REM          SUBROUTINE TO CONVERT NUMBER TO EXPONENTIAL NOTATION
5520 LET N$="+0.000E+00"
5530 IF X=0 THEN GOTO 5720
5540 IF X<0 THEN LET N$[1,1]="-"
5550 LET X=ABS(X)
5560 LET E=0
5570 IF X<.9995 THEN GOTO 5620
5580 IF X<9.9995 THEN GOTO 5650
5590 LET X=X/10
5600 LET E=E+1
5610 GOTO 5570
5620 LET X=X*10
5630 LET E=E-1
5640 GOTO 5570
5650 LET X=X+5E-04

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0       0
```

```
C-O-N-T-I-N-U-O-U-S   F-L-O-W   A-N-A-L-Y-Z-E-R   A-U-T-O   S-Y-S-T-E-M
5/23/1980                                                          PAGE 15
                        PROGRAM LISTING FOR CFA01

 1234567891123456789212345678931234567894123456789512345678961234567897
          0         0         0         0         0         0        0
 5660 LET N1$=STR$(X)
 5670 IF LEN(N1$)>5 THEN LET N1$=N1$[1,5]
 5680 LET N$[2,LEN(N1$)+1]=N1$
 5690 IF E<0 THEN LET N$[8,8]="-"
 5700 LET N1$=STR$(ABS(E))
 5710 LET N$[11-LEN(N1$),10]=N1$
 5720 RETURN
 1234567891123456789212345678931234567894123456789512345678961234567897
          0         0         0         0         0         0        0
```

```
C-O-N-T-I-N-U-O-U-S   F-L-O-W   A-N-A-L-Y-Z-E-R   A-U-T-O   S-Y-S-T-E-M
5/23/1980                                                          PAGE 16
                        SYMBOL TABLE FOR CFA01

SYMBOL    REFERENCES
------   ---------------------------------------------------------------
 0110    0090  5440
 0140    0100
 0190    0170
 0220    0310  0320  0380
 0270    0210  1500  5450
 0300    0280
 0410    0340
 1120    1090
 1200    1080
 1250    1200  1210  1220  1230
 1270    1240
 1300    1270
 1330    1300
 1420    1330
 1430    1110  1190  1260  1290  1320  1410
 1530    0200  0350
 1550    1530
 1590    1570
 1630    1610
 1690    1580  1830
 1720    1700
 1760    1730
 1790    1770
 1840    1750  1800
 1870    1990  2040
 1920    1880
 1940    1920
 2000    1950
 2050    2000  2070
 2080    2050
 2100    2170
 2130    2110
 2180    2140
 2410    2390
 2630    2830  2840
 2640    2960
 2740    2620
 2750    3310  3690  3790  4300  4410  4760  4940  5260  5380
 2760    3290  4740
 2790    2750
 2820    2800
 2990    2850  3150
 3020    3000
 3070    3050
 3090    3030
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C-O-N-T-I-N-U-O-U-S   F-L-O-W   A-N-A-L-Y-Z-E-R   A-U-T-O   S-Y-S-T-E-M
5/23/1980                                                         PAGE 17
                   SYMBOL TABLE FOR CFA01

SYMBOL   REFERENCES
______   ________________________________________________________________

 3100    3080
 3160    3100
 3340    2860
 3350    3460
 3370    3350
 3420    3380  3390  3400
 3470    3410
 3560    3490
 3640    3570
 3650    3480  3960  4130
 3700    3550  3560  3630  3640
 3820    2870
 3830    3940
 3850    3830
 3900    3860  3870  3880
 3950    3890
 4040    3970
 4110    4040
 4140    4030  4100  4110  4120
 4230    4170  4180  4190  4200  4210
 4310    4240
 4440    2880
 4450    4600
 4470    4450
 4520    4500
 4540    4480
 4550    4530
 4610    4550
 4790    2890
 4870    4850
 4970    2900
 5030    5190
 5080    5040
 5100    5080
 5200    5070  5120
 5290    2910
 5410    2780  2920
 5480    0330
 5520    2470  4880  5200
 5570    5610  5640
 5620    5570
 5650    5580
 5720    5530
 A$      0080  0290  0310  0320  0330  0340  0350  1710  1730  1780
         1930  1950  2000  2050  2060  2080  2810  2830  2840  2850
```

```
C-O-N-T-I-N-U-O-U-S   F-L-O-W   A-N-A-L-Y-Z-E-R   A-U-T-O   S-Y-S-T-E-M
5/23/1980                                                         PAGE 18
                   SYMBOL TABLE FOR CFA01

SYMBOL   REFERENCES
______   ________________________________________________________________

         2860  2870  2880  2890  2900  2910  2920  3010  3030  3060
         4460  4480  4510
 A1$     0080  0420  0520  0900  1840  2080  2180  2360  4840  5030
         5420
 A2$     0080  2180  2220  2290  2480  3240  3730  4340  4690  4890
         5210  5330
 A3$     0080  0710  0720  0730  0750  0760  1040  1050  1060  1070
         1080  1090  1140  1150  1200  1210  1220  1230  1270  1280
         1300  1330  1360  1370  1420  2220  2230  2290  2300  2480
         2490  3240  3250  3470  3480  3490  3510  3520  3530  3560
         3570  3590  3600  3610  3640  3730  3740  3750  3950  3960
         3970  3990  4000  4010  4040  4060  4070  4080  4110  4120
         4160  4170  4180  4190  4200  4210  4340  4350  4360  4370
         4650  4660  4690  4700  4890  4900  4970  4980  5210  5220
         5330  5340
 A4$     0080  2580  2590  3200  3700  4310  4790  5300
 AC      0080  2400  2460  5050  5060  5120
 D9      4140  4220  4240  4360
 E       5560  5600  5630  5690  5700
 FL#0    0410  0420  0750  1070  1140  1360  1490  1560  2230  2300
         2490  3200  3250  3470  3510  3530  3590  3610  3700  3750
         3950  3990  4010  4060  4080  4160  4310  4370  4660  4700
         4790  4900  4980  5220  5300  5340  5420  5430
 I       0510  0520  0530  0560  0580  0610  0630  0700  0720  0750
         0800  0890  0900  0910  0940  0960  0990  1010  1030  1050
         1070  1140  1360  1430  1860  1890  1900  1910  2090  2200
         2260  2270  2330  2340  2360  2400  2430  2440  2460  2520
         3160  3170  3180  3190  3300  3500  3510  3530  3540  3580
         3590  3610  3620  3980  3990  4010  4020  4050  4060  4080
         4090  4150  4160  4230  4610  4620  4630  4640  4750  4810
         4830  4840  4890  4920  5000  5020  5030  5040  5050  5060
         5120  5210  5240  5320  5330  5360
 J       0740  0750  0780  1130  1140  1170  1350  1360  1390  2210
         2220  2250  2280  2290  2320  2370  2380  2400  2420  2450
         2460  2480  2510  3230  3240  3270  3720  3730  3770  4330
         4340  4390  4680  4690  4720  5050  5060  5110  5120  5130
 N       0420  0510  0560  0610  0740  0750  0890  0940  0990  1070
         1130  1140  1350  1360  1740  1760  1780  1800  1860  1880
         2210  2280  2340  2450  2590  3230  3470  3500  3510  3530
         3580  3590  3610  3720  3950  3980  3990  4010  4050  4060
         4080  4160  4330  4680  4810  5000  5320  5420
 N$      0080  2480  4890  5210  5520  5540  5680  5690  5710
 N1      0420  0700  1070  1140  1360  2120  2140  2370  2440  5110
         5420
 N1$     0080  5660  5670  5680  5700  5710
```

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C-O-N-T-I-N-U-O-U-S  F-L-O-W  A-N-A-L-Y-Z-E-R  A-U-T-O  S-Y-S-T-E-M
5/23/1980                                                      PAGE 19
                        SYMBOL TABLE FOR CFA01

SYMBOL    REFERENCES
------    ------------------------------------------------------------
  N3      0420  1030  2550  2750  2790  3160  3280  3290  3390  3670
          3780  3870  4150  4280  4400  4610  4730  4740  4930  5250
          5370  5420
  N4      3040  3060  3090  3100  3160  3190  4490  4510  4540  4550
          4610  4640
  N5      3360  3380  3390  3400  3470  3510  3530  3590  3610  3660
          3740  3840  3860  3870  3880  3950  3990  4010  4060  4080
          4150  4210  4270  4350
  N9      2560  3220  5420
  R       2190  2230  2240  2300  2310  2490  2500  2570  3200  3210
          3250  3260  3700  3710  3750  3760  4310  4320  4370  4380
          4660  4670  4700  4710  4790  4800  4900  4910  4980  4990
          5220  5230  5300  5310  5340  5350
  R2      2570  3470  3510  3530  3590  3610  3950  3990  4010  4060
          4080  4160
  X       2460  4860  5060  5090  5120  5530  5540  5550  5570  5580
          5590  5620  5650  5660
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SECTION 4

PROGRAM CFA02 - NON-SFC RUN FILE GENERATOR

CFA02 is the program which generates and displays quality control limits and creates run files. It replaces the backlog editing programs of the Sample File Control System[4] for non-SFC users.

CFA02 is entered by chaining from the template generating program, CFA01. It chains back to CFA00 if the ESCAPE key is pressed at any time during its execution.

6-1/2"

The program first confronts the user with three choices: 1) accept the existing limits, 2) display the existing limits, or 3) generate new limits.

If the user chooses to accept the existing limits, the program checks to be sure that the existing limits match the existing templates, and then branches to the section of the program which assembles the run file.

If the user chooses to display the existing limits, the program checks to be sure that the existing limits match the existing templates. It then copies the limits for each analyte from file CFA002 and displays them at the terminal. The program then branches back to the quality control limits menu.

If the user chooses to generate new quality control limits, the program asks the user for the necessary values for spikes, control standard, reagent blanks, and duplicates for each analyte. The user may simply accept default values rather than enter calculated values. The program then branches back to the quality control limits options question.

When a set of quality control limits has been accepted, the program allows the user to generate a run file. Run files generated by this program are always named 0000000.RF. The first step of this process is to have the user specify the ID numbers to be used. The program checks to be sure that each ID number is unique.

The program then copies the calibration template from CFA001 to 0000000.RF. It then copies the sample template from CFA001 to 0000000.RF, filling in the ID numbers of the unknowns, spikes, and duplicates in the process. The quality control limits for spikes, control standards, reagent blanks, and duplicates are also placed into 0000000.RF, as are the LCM records for control standards and the LSA records for spikes.

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The sample template is used repeatedly, if necessary, but is always used an integral number of times. When there are not enough ID numbers left to fill a complete template, the leftover ID numbers are assigned to simple unknowns which are added to the run file. Finally, four blanks are added to the end of the run file. The program then chains back to CFA00.

EPA-287 (Cin.)
(4-76)

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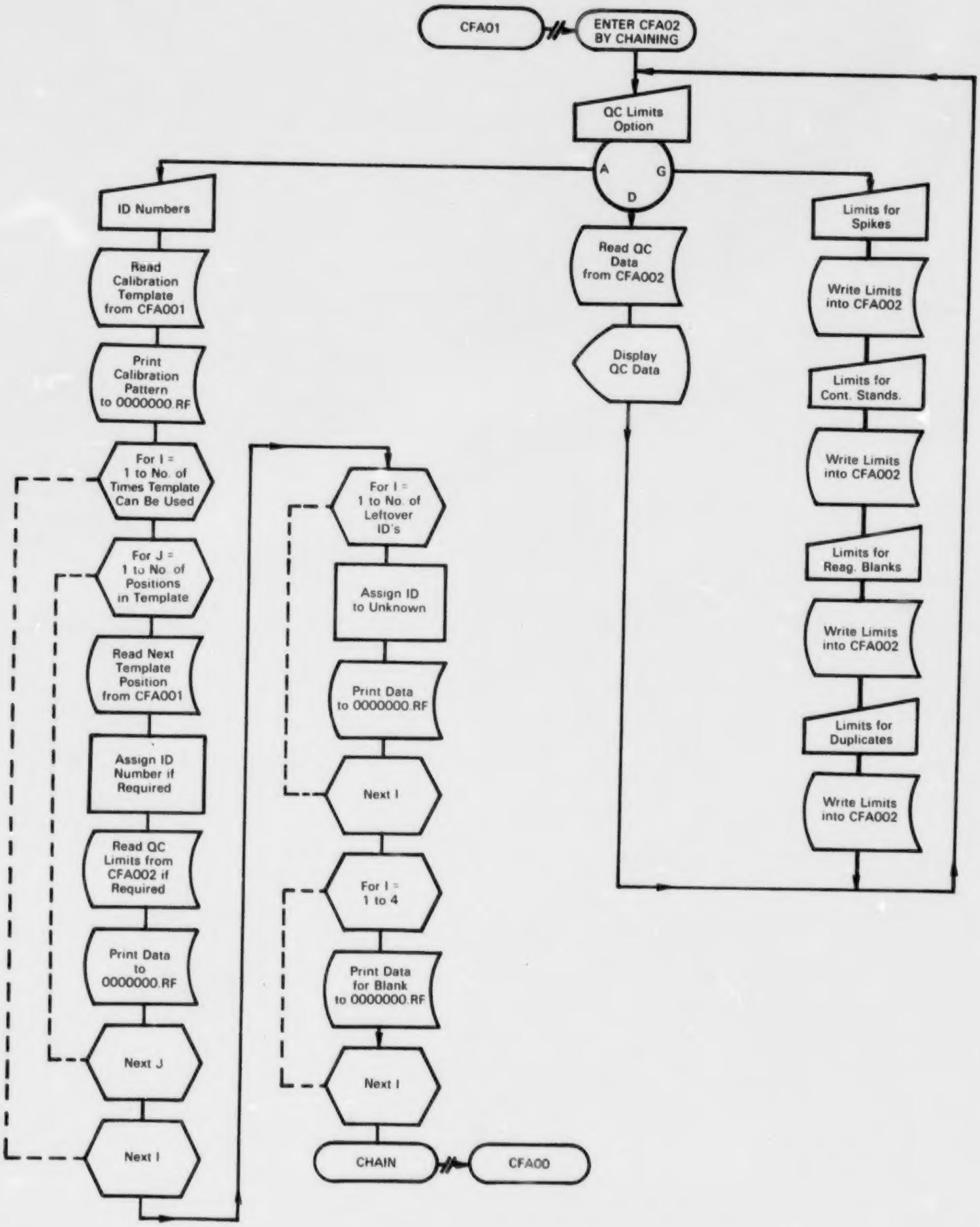
CFA01
ENTER CFA02 BY CHAINING
QC Limits Option
A
G
D
ID Numbers
Read Calibration Template from CFA001
Print Calibration Pattern to 0000000.RF
For I = 1 to No. of Times Template Can Be Used
For J = 1 to No. of Positions in Template
Read Next Template Position from CFA001
Assign ID Number if Required
Read QC Limits from CFA002 if Required
Print Data to 0000000.RF
Next J
Next I
For I = 1 to No. of Leftover ID's
Assign ID to Unknown
Print Data to 0000000.RF
Next I
For I = 1 to 4
Print Data for Blank to 0000000.RF
Next I
CHAIN
CFA00
Read QC Data from CFA002
Display QC Data
Limits for Spikes
Write Limits into CFA002
Limits for Cont. Stands.
Write Limits into CFA002
Limits for Reag. Blanks
Write Limits into CFA002
Limits for Duplicates
Write Limits into CFA002

Figure 4. Functional Flowchart of Program CFA02.

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(4-76)

TABLE 3. SYMBOL DEFINITIONS FOR PROGRAM CFA02

A$	the user's answer to most questions
A1$	the superstring containing the names of the analytes
A2$	the superstring containing the three dummy parameter-method codes
A3$	a multi-purpose string of formatted data
A7$	the superstring of quality control limit types
A8$	the formatted string record for an LCM
D8()	the array which shows which ID number has been assigned to each template position
E	the exponent for a number in scientific notation
F	the factor by which sigma is multiplied in the calculation of control and warning limits
F8	the position in array I9 of the first ID which will be added to the end of a run file as a leftover sample
F9	the first of a series of ID numbers
I	the control variable for loops
I9()	the array of ID numbers
J	the control variable for loops
K	the control variable for loops
L	the control variable for loops
L9	the last of a series of ID numbers
M1	the mean in control limits
N	the number of analytes
N$	a number in scientific notation
N1	the number of calibration standards
N1$	part of a number being transformed into scientific notation
N3	the number of positions in the sample template
N9	the number of positions for unknowns in the sample template
R	the number of the next record to be written into
R3	the position in array I9 of the next ID number
R4	the number of ID numbers in the batch
S1	the value for sigma in control limits
X	a number being passed to the subroutine to be converted into scientific notation
Z7	the position in array D8 of the ID number of the unknown associated with a spike or duplicate

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C-O-N-T-I-N-U-O-U-S   F-L-O-W   A-N-A-L-Y-Z-E-R   A-U-T-O   S-Y-S-T-E-M
5/23/1980                                                          PAGE  1
                     PROGRAM LISTING FOR CFA02

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
0010 REM   +=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+
0020 REM   +   CONTINUOUS FLOW ANALYZER AUTOMATION SYSTEM               +
0030 REM   +   PROGRAM CFA02, NON-SFC RUN FILE GENERATOR                +
0040 REM   +   BY:  J. KOPKE (UCCC)       JANUARY 9, 1980               +
0050 REM   +   MOST RECENT REVISION:  APRIL 15, 1980                    +
0060 REM   +=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+
0070 REM
0080 DIM A$[8],A1$[21],A2$[21],A3$[79],A7$[15],A8$[79],D8[200],I9[200]
*        ,N$[10],N1$[10]
0090 ON ESC THEN GOTO 0110
0100 GOTO 0140
0110 NOESC
0120 CLOSE
0130 CHAIN "CFA00"
0140 ESC
0150 REM   ------------------------------------------------------------
0160 REM            QC LIMITS MASTER QUESTION
0170 ON ERR THEN GOTO 0190
0180 RENAME "CFA002","CFA002"
0190 ON ERR THEN STOP
0200 IF SYS(7)=-10 THEN GOTO 0940
0210 GOTO 0270
0220 PRINT
0230 PRINT "H = HELP"
0240 PRINT "A = ACCEPT EXISTING QC LIMITS"
0250 PRINT "D = DISPLAY EXISTING QC LIMITS"
0260 PRINT "G = GENERATE NEW QC LIMITS"
0270 PRINT
0280 ON ERR THEN GOTO 0300
0290 INPUT "QC LIMITS ([H],A,D,G) >>  ",A$
0300 ON ERR THEN STOP
0310 IF A$="" THEN GOTO 0220
0320 IF A$="H" THEN GOTO 0220
0330 IF A$="A" THEN GOTO 3190
0340 IF A$="D" THEN GOTO 0410
0350 IF A$="G" THEN GOTO 0940
0360 PRINT
0370 PRINT "<7>INVALID RESPONSE"
0380 GOTO 0220
0390 REM   ------------------------------------------------------------
0400 REM             DISPLAY QC LIMITS
0410 OPEN FILE[0,0],"CFA001",80

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
```

```
C-O-N-T-I-N-U-O-U-S   F-L-O-W   A-N-A-L-Y-Z-E-R   A-U-T-O   S-Y-S-T-E-M
5/23/1980                                                          PAGE  2
                     PROGRAM LISTING FOR CFA02

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
0420 READ FILE[0,0],N,A1$
0430 CLOSE FILE[0]
0440 OPEN FILE[1,0],"CFA002",80
0450 READ FILE[1,0],A3$
0460 IF A3$=A1$ THEN GOTO 0520
0470 PRINT
0480 PRINT "<7>THE EXISTING QC LIMITS WERE NOT GENERATED FOR THE CURRE
*    NT"
0490 PRINT "ANALYTES;  GENERATE NEW ONES"
0500 CLOSE
0510 GOTO 0270
0520 PRINT
0530 PRINT
0540 PRINT
0550 PRINT
0560 PRINT
0570 LET R=1
0580 PRINT  TAB(29);"Q-C   L-I-M-I-T-S"
0590 FOR I=1 TO N
0600   LET A7$="UCLUWLAVELWLLCL"
0610   PRINT
0620   PRINT "LIMITS FOR ";A1$[I*7-6,I*7];":"
0630   FOR J=1 TO 3
0640     PRINT
0650     IF J=1 THEN PRINT "     SPIKED SAMPLES:"
0660     IF J=2 THEN PRINT "     LABORATORY CONTROL STANDARDS:"
0670     IF J=3 THEN PRINT "     REAGENT BLANKS:"
0680     FOR K=1 TO 5
0690       READ FILE[1,R],A3$
0700       LET R=R+1
0710       PRINT USING "          ### = ----#.###",A7$[3*K-2,3*K],VAL(
*   A3$[28,37]);
0720       IF J<3 THEN PRINT "%"
0730       IF J=3 THEN PRINT
0740     NEXT K
0750   NEXT J
0760   PRINT
0770   PRINT "     DUPLICATES:"
0780   LET A7$="ABCD"
0790   FOR J=1 TO 4
0800     READ FILE[1,R],A3$
0810     LET R=R+1

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
```

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BOTTOM OF IMAGE AREA OUTSIDE DIMENSION FOR TABLES AND ILLUSTRATIONS
EPA-287 (Cin.)
(4-76)

```
C-O-N-T-I-N-U-O-U-S   F-L-O-W   A-N-A-L-Y-Z-E-R   A-U-T-O   S-Y-S-T-E-M
5/23/1980                                                      PAGE  3
                      PROGRAM LISTING FOR CFA02

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
0820     PRINT USING "          # = ——#.###",A7$[J,J],VAL(A3$[28,37]
#      )
0830      NEXT J
0840 NEXT I
0850 PRINT
0860 PRINT
0870 PRINT
0880 PRINT
0890 PRINT
0900 CLOSE FILE[1]
0910 GOTO 0270
0920 REM  ————————————————————————————————————————————————————————
0930 REM          GENERATE QC LIMITS
0940 OPEN FILE[0,0],"CFA001",80
0950 READ FILE[0,0],N,A1$
0960 CLOSE FILE[0]
0970 ON ERR THEN GOTO 0990
0980 DELETE "CFA002"
0990 ON ERR THEN STOP
1000 OPEN FILE[1,0],"CFA002",80
1010 ON ESC THEN GOTO 1030
1020 GOTO 1110
1030 NOESC
1040 CLOSE
1050 ON ERR THEN GOTO 1070
1060 DELETE "CFA002"
1070 ON ERR THEN STOP
1080 PRINT
1090 PRINT "<7>ALL QC LIMITS HAVE BEEN DELETED BECAUSE THEY WERE INCOM
#     PLETE"
1100 CHAIN "CFA00"
1110 LET R=1
1120 LET A2$=A1$
1130 FOR I=1 TO N
1140    PRINT
1150    PRINT "GENERATE QC LIMITS FOR ";A1$[I*7-6,I*7];":"
1160    REM   ——————————————————————————————
1170    REM          SPIKED SAMPLES
1180    PRINT
1190    PRINT "     SPIKED SAMPLES:"
1200    ON ERR THEN GOTO 1220
1210    INPUT "            MEAN ([100%],——) >>  ",A$

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
```

```
C-O-N-T-I-N-U-O-U-S   F-L-O-W   A-N-A-L-Y-Z-E-R   A-U-T-O   S-Y-S-T-E-M
5/23/1980                                                      PAGE  4
                      PROGRAM LISTING FOR CFA02

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
1220     ON ERR THEN STOP
1230     IF A$<>"" THEN GOTO 1260
1240     LET M1=100
1250     GOTO 1350
1260     LET M1=-100
1270     ON ERR THEN GOTO 1290
1280     LET M1=VAL(A$)
1290     ON ERR THEN STOP
1300     IF M1>0 THEN GOTO 1350
1310     PRINT
1320     PRINT "<7>           INVALID RESPONSE"
1330     PRINT
1340     GOTO 1200
1350     ON ERR THEN GOTO 1370
1360     INPUT "          SIGMA ([5%],——) >>  ",A$
1370     ON ERR THEN STOP
1380     IF A$<>"" THEN GOTO 1410
1390     LET S1=5
1400     GOTO 1500
1410     LET S1=-5
1420     ON ERR THEN GOTO 1440
1430     LET S1=VAL(A$)
1440     ON ERR THEN STOP
1450     IF S1>0 THEN GOTO 1500
1460     PRINT
1470     PRINT "<7>           INVALID RESPONSE"
1480     PRINT
1490     GOTO 1350
1500     LET A7$="UCLUWLAVELWLLCL"
1510     LET A3$="4 LSPK         P    ",A2$[7*I-6,7*I],"            00/00
#     /00
1520     FOR J=1 TO 5
1530        IF J=1 THEN LET F=3
1540        IF J=2 THEN LET F=2
1550        IF J=3 THEN LET F=0
1560        IF J=4 THEN LET F=-2
1570        IF J=5 THEN LET F=-3
1580        LET X=M1+S1*F
1590        GOSUB 5910
1600        LET A3$[28,37]=N$
1610        LET A3$[12,14]=A7$[J*3-2,J*3]
1620        WRITE FILE[1,R],A3$

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
```

EPA-287 (Cin.)
(4-76)

TYPING GUIDE SHEET

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TOP OF IMAGE AREA

```
C-O-N-T-I-N-U-O-U-S  F-L-O-W  A-N-A-L-Y-Z-E-R  A-U-T-O  S-Y-S-T-E-M
5/23/1980                                                     PAGE  5
                    PROGRAM LISTING FOR CFA02

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
1630      LET R=R+1
1640    NEXT J
1650    REM   ________________________________
1660    REM           LAB CONTROL STANDARDS
1670    PRINT
1680    PRINT "     LABORATORY CONTROL STANDARDS:"
1690    ON ERR THEN GOTO 1710
1700    INPUT "               MEAN ([100%],---) >>  ",A$
1710    ON ERR THEN STOP
1720    IF A$<>"" THEN GOTO 1750
1730    LET M1=100
1740    GOTO 1840
1750    LET M1=-100
1760    ON ERR THEN GOTO 1780
1770    LET M1=VAL(A$)
1780    ON ERR THEN STOP
1790    IF M1>0 THEN GOTO 1840
1800    PRINT
1810    PRINT "<7>           INVALID RESPONSE"
1820    PRINT
1830    GOTO 1690
1840    ON ERR THEN GOTO 1860
1850    INPUT "               SIGMA ([5%],---) >>  ",A$
1860    ON ERR THEN STOP
1870    IF A$<>"" THEN GOTO 1900
1880    LET S1=5
1890    GOTO 1990
1900    LET S1=-5
1910    ON ERR THEN GOTO 1930
1920    LET S1=VAL(A$)
1930    ON ERR THEN STOP
1940    IF S1>0 THEN GOTO 1990
1950    PRINT
1960    PRINT "<7>           INVALID RESPONSE"
1970    PRINT
1980    GOTO 1840
1990    LET A3$[3,6]="LCST"
2000    FOR J=1 TO 5
2010      IF J=1 THEN LET F=3
2020      IF J=2 THEN LET F=2
2030      IF J=3 THEN LET F=0
2040      IF J=4 THEN LET F=-2

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
```

```
C-O-N-T-I-N-U-O-U-S  F-L-O-W  A-N-A-L-Y-Z-E-R  A-U-T-O  S-Y-S-T-E-M
5/23/1980                                                     PAGE  6
                    PROGRAM LISTING FOR CFA02

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
2050      IF J=5 THEN LET F=-3
2060      LET X=M1+S1*F
2070      GOSUB 5910
2080      LET A3$[28,37]=N$
2090      LET A3$[12,14]=A7$[J*3-2,J*3]
2100      WRITE FILE[1,R],A3$
2110      LET R=R+1
2120    NEXT J
2130    REM   ________________________________
2140    REM           REAGENT BLANKS
2150    PRINT
2160    PRINT "     REAGENT BLANKS:"
2170    ON ERR THEN GOTO 2190
2180    INPUT "               MEAN ([0],---) >>  ",A$
2190    ON ERR THEN STOP
2200    IF A$<>"" THEN GOTO 2230
2210    LET M1=0
2220    GOTO 2320
2230    LET M1=-100
2240    ON ERR THEN GOTO 2260
2250    LET M1=VAL(A$)
2260    ON ERR THEN STOP
2270    IF M1>-99 THEN GOTO 2320
2280    PRINT
2290    PRINT "<7>           INVALID RESPONSE"
2300    PRINT
2310    GOTO 2170
2320    ON ERR THEN GOTO 2340
2330    INPUT "               SIGMA ([5],---) >>  ",A$
2340    ON ERR THEN STOP
2350    IF A$<>"" THEN GOTO 2380
2360    LET S1=5
2370    GOTO 2460
2380    LET S1=-5
2390    ON ERR THEN GOTO 2410
2400    LET S1=VAL(A$)
2410    ON ERR THEN STOP
2420    IF S1>0 THEN GOTO 2460
2430    PRINT
2440    PRINT "<7>           INVALID RESPONSE"
2450    GOTO 2320
2460    LET A3$[3,6]="LRBL"

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
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BOTTOM OF IMAGE AREA OUTSIDE DIMENSION FOR TABLES AND ILLUSTRATIONS

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```
C-O-N-T-I-N-U-O-U-S   F-L-O-W   A-N-A-L-Y-Z-E-R   A-U-T-O   S-Y-S-T-E-M
5/23/1980                                                        PAGE  7
                    PROGRAM LISTING FOR CFA02

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
2470   FOR J=1 TO 5
2480     IF J=1 THEN LET F=3
2490     IF J=2 THEN LET F=2
2500     IF J=3 THEN LET F=0
2510     IF J=4 THEN LET F=-2
2520     IF J=5 THEN LET F=-3
2530     LET X=M1+S1*F
2540     GOSUB 5910
2550     LET A3$[28,37]=N$
2560     LET A3$[12,14]=A7$[J*3-2,J*3]
2570     WRITE FILE[1,R],A3$
2580     LET R=R+1
2590   NEXT J
2600   REM    ________________________________
2610   REM            DUPLICATES
2620   PRINT
2630   PRINT "     DUPLICATES:"
2640   LET A3$[3,6]="LDUP"
2650   LET A3$[12,14]="A  "
2660   LET A3$[28,37]="+0.000E+00"
2670   WRITE FILE[1,R],A3$
2680   LET R=R+1
2690   LET A3$[12,12]="B"
2700   WRITE FILE[1,R],A3$
2710   LET R=R+1
2720   ON ERR THEN GOTO 2740
2730   INPUT "                C ([.15],---) >>  ",A$
2740   ON ERR THEN STOP
2750   IF A$<>"" THEN GOTO 2780
2760   LET X=.15
2770   GOTO 2870
2780   LET X=-99999
2790   ON ERR THEN GOTO 2810
2800   LET X=VAL(A$)
2810   ON ERR THEN STOP
2820   IF X<>-99999 THEN GOTO 2870
2830   PRINT
2840   PRINT "<7>          INVALID RESPONSE"
2850   PRINT
2860   GOTO 2720
2870   GOSUB 5910
2880   LET A3$[28,37]=N$

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
```

```
C-O-N-T-I-N-U-O-U-S   F-L-O-W   A-N-A-L-Y-Z-E-R   A-U-T-O   S-Y-S-T-E-M
5/23/1980                                                        PAGE  8
                    PROGRAM LISTING FOR CFA02

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
2890   LET A3$[12,12]="C"
2900   WRITE FILE[1,R],A3$
2910   LET R=R+1
2920   ON ERR THEN GOTO 2940
2930   INPUT "                D ([0],---) >>  ",A$
2940   ON ERR THEN STOP
2950   IF A$<>"" THEN GOTO 2980
2960   LET X=0
2970   GOTO 3070
2980   LET X=-99999
2990   ON ERR THEN GOTO 3010
3000   LET X=VAL(A$)
3010   ON ERR THEN STOP
3020   IF X<>-99999 THEN GOTO 3070
3030   PRINT
3040   PRINT "<7>          INVALID RESPONSE"
3050   PRINT
3060   GOTO 2920
3070   GOSUB 5910
3080   LET A3$[28,37]=N$
3090   LET A3$[12,12]="D"
3100   WRITE FILE[1,R],A3$
3110   LET R=R+1
3120 NEXT I
3130 WRITE FILE[1,0],A1$
3140 CLOSE FILE[1]
3150 ON ESC THEN GOTO 0110
3160 GOTO 0270
3170 REM    ________________________________________
3180 REM          CREATE RUN FILE
3190 OPEN FILE[0,0],"CFA001",80
3200 READ FILE[0,0],N,A1$
3210 OPEN FILE[1,0],"CFA002",80
3220 READ FILE[1,0],A3$
3230 IF A3$<>A1$ THEN GOTO 0470
3240 ON ERR THEN GOTO 3260
3250 DELETE "0000000.RF"
3260 ON ERR THEN STOP
3270 LET R3=1
3280 PRINT
3290 PRINT "SPECIFY ID NUMBERS FOR THE UNKNOWNS:"
3300 PRINT "TYPE 0 (ZERO) AS AN ID TO END THE LIST"

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
```

EPA-287 (Cin.)
(4-76)

```
C-O-N-T-I-N-U-O-U-S   F-L-O-W   A-N-A-L-Y-Z-E-R   A-U-T-O   S-Y-S-T-E-M
5/23/1980                                                          PAGE  9
                      PROGRAM LISTING FOR CFA02

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
3310 PRINT
3320 ON ERR THEN GOTO 3340
3330 INPUT "      FIRST ID >>  ",F9
3340 ON ERR THEN STOP
3350 IF F9=0 THEN GOTO 3670
3360 ON ERR THEN GOTO 3380
3370 INPUT "      LAST ID >>  ",L9
3380 ON ERR THEN STOP
3390 IF L9=0 THEN GOTO 3670
3400 IF F9<>INT(ABS(F9)) THEN GOTO 3460
3410 IF L9<>INT(ABS(L9)) THEN GOTO 3460
3420 IF L9<F9 THEN GOTO 3460
3430 IF F9>999999 THEN GOTO 3460
3440 IF L9>999999 THEN GOTO 3460
3450 GOTO 3490
3460 PRINT
3470 PRINT "<7>      INVALID RESPONSE"
3480 GOTO 3310
3490 FOR I=F9 TO L9
3500   FOR J=1 TO R3-1
3510     IF I9[J]<>I THEN GOTO 3560
3520     PRINT
3530     PRINT "<7>      TWO ID NUMBERS WOULD BE THE SAME;"
3540     PRINT "      THE LAST PAIR OF ENTRIES HAS BEEN IGNORED"
3550     GOTO 3310
3560   NEXT J
3570 NEXT I
3580 FOR I=F9 TO L9
3590   LET I9[R3]=I
3600   LET R3=R3+1
3610   IF R3<201 THEN GOTO 3650
3620   PRINT
3630   PRINT "<7>THE LIMIT OF 200 UNKNOWNS HAS BEEN REACHED"
3640   GOTO 3670
3650 NEXT I
3660 GOTO 3310
3670 LET R4=R3-1
3680 PRINT
3690 PRINT "THE RUN FILE IS BEING ASSEMBLED...";
3700 OPEN FILE[3,1],"0000000.RF"
3710 ON ESC THEN GOTO 3730
3720 GOTO 3810

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
```

```
C-O-N-T-I-N-U-O-U-S   F-L-O-W   A-N-A-L-Y-Z-E-R   A-U-T-O   S-Y-S-T-E-M
5/23/1980                                                         PAGE 10
                      PROGRAM LISTING FOR CFA02

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
3730 NOESC
3740 CLOSE
3750 ON ERR THEN GOTO 3770
3760 DELETE "000YZNN.RF"
3770 ON ERR THEN STOP
3780 PRINT
3790 PRINT "<7>THE RUN FILE HAS BEEN DELETED BECAUSE IT WAS INCOMPLETE
*    "
3800 CHAIN "CFA00"
3810 LET A3$="1 00 00 00 00 00 IIII  000YZNN III
*                                 "
3820 PRINT FILE[3],A3$
3830 REM      _____________________________________
3840 REM              CALIBRATION PATTERN
3850 READ FILE[0,0],N,A1$,N1,N3,N9
3860 FOR I=1 TO N*5
3870   READ FILE[0,I],A3$
3880   PRINT FILE[3],A3$
3890 NEXT I
3900 FOR I=N*5+1 TO N*(N1+5)
3910   READ FILE[0,I],A3$
3920   PRINT FILE[3],A3$
3930 NEXT I
3940 PRINT ".";
3950 LET R3=1
3960 IF N9=0 THEN GOTO 5600
3970 FOR I=1 TO INT(R4/N9)
3980   FOR J=1 TO N3
3990     READ FILE[0,N*(N1+5)+(N+1)*(J-1)+1],A3$
4000     REM          BLANKS AND CHECK STANDARDS
4010     IF A3$[1,1]<>"9" THEN GOTO 4070
4020     FOR K=1 TO N
4030       READ FILE[0,N*(N1+5)+(N+1)*(J-1)+1+K],A3$
4040       PRINT FILE[3],A3$
4050     NEXT K
4060     GOTO 5550
4070     READ FILE[0,N*(N1+5)+(N+1)*(J-1)+2],A3$
4080     REM      _____________________________________
4090     REM              REAGENT BLANKS
4100     IF A3$[12,14]<>"LRB" THEN GOTO 4250
4110     IF N=1 THEN GOTO 4140
4120     READ FILE[0,N*(N1+5)+(N+1)*(J-1)+1],A3$

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
```

```
C-O-N-T-I-N-U-O-U-S  F-L-O-W  A-N-A-L-Y-Z-E-R  A-U-T-O  S-Y-S-T-E-M
5/23/1980                                                     PAGE 11
                    PROGRAM LISTING FOR CFA02

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
4130       PRINT FILE[3],A3$
4140       FOR K=1 TO N
4150         READ FILE[0,N*(N1+5)+(N+1)*(J-1)+1+K],A3$
4160         PRINT FILE[3],A3$
4170         FOR L=1 TO 5
4180           READ FILE[1,19*(K-1)+10+L],A3$
4190           PRINT FILE[3],A3$
4200         NEXT L
4210       NEXT K
4220       GOTO 5550
4230       REM ----------------------------------
4240       REM          CONTROL STANDARDS
4250       IF A3$[12,14]<>"LCT" THEN GOTO 4420
4260       IF N=1 THEN GOTO 4290
4270       READ FILE[0,N*(N1+5)+(N+1)*(J-1)+1],A3$
4280       PRINT FILE[3],A3$
4290       FOR K=1 TO N
4300         READ FILE[0,N*(N1+5)+(N+1)*(J-1)+1+K],A3$
4310         LET A8$=A3$[1,11],"LCM",A3$[15,27],"          ",A3$[38,79]
4320         PRINT FILE[3],A8$
4330         PRINT FILE[3],A3$
4340         FOR L=1 TO 5
4350           READ FILE[1,19*(K-1)+5+L],A3$
4360           PRINT FILE[3],A3$
4370         NEXT L
4380       NEXT K
4390       GOTO 5550
4400       REM ----------------------------------
4410       REM          UNKNOWNS WITH NO QC
4420       IF A3$[12,14]<>"   " THEN GOTO 4580
4430       IF N=1 THEN GOTO 4480
4440       READ FILE[0,N*(N1+5)+(N+1)*(J-1)+1],A3$
4450       LET A3$[3,10]="00000000"
4460       LET A3$[11-LEN(STR$(I9[R3])),10]=STR$(I9[R3])
4470       PRINT FILE[3],A3$
4480       FOR K=1 TO N
4490         READ FILE[0,N*(N1+5)+(N+1)*(J-1)+1+K],A3$
4500         LET A3$[3,10]="00000000"
4510         LET A3$[11-LEN(STR$(I9[R3])),10]=STR$(I9[R3])
4520         PRINT FILE[3],A3$
4530       NEXT K
4540       LET R3=R3+1

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
```

```
C-O-N-T-I-N-U-O-U-S  F-L-O-W  A-N-A-L-Y-Z-E-R  A-U-T-O  S-Y-S-T-E-M
5/23/1980                                                     PAGE 12
                    PROGRAM LISTING FOR CFA02

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
4550       GOTO 5550
4560       REM ----------------------------------
4570       REM          UNKNOWNS WITH DUPLICATES
4580       IF A3$[12,14]<>"LD1" THEN GOTO 4790
4590       IF N=1 THEN GOTO 4640
4600       READ FILE[0,N*(N1+5)+(N+1)*(J-1)+1],A3$
4610       LET A3$[3,10]="00000000"
4620       LET A3$[11-LEN(STR$(I9[R3])),10]=STR$(I9[R3])
4630       PRINT FILE[3],A3$
4640       FOR K=1 TO N
4650         READ FILE[0,N*(N1+5)+(N+1)*(J-1)+1+K],A3$
4660         LET A3$[3,10]="00000000"
4670         LET A3$[11-LEN(STR$(I9[R3])),10]=STR$(I9[R3])
4680         PRINT FILE[3],A3$
4690         FOR L=1 TO 4
4700           READ FILE[1,19*(K-1)+15+L],A3$
4710           PRINT FILE[3],A3$
4720         NEXT L
4730       NEXT K
4740       LET DB[J]=I9[R3]
4750       LET R3=R3+1
4760       GOTO 5550
4770       REM ----------------------------------
4780       REM          UNKNOWNS WITH SPIKES
4790       IF A3$[12,14]<>"LSD" THEN GOTO 5000
4800       IF N=1 THEN GOTO 4850
4810       READ FILE[0,N*(N1+5)+(N+1)*(J-1)+1],A3$
4820       LET A3$[3,10]="00000000"
4830       LET A3$[11-LEN(STR$(I9[R3])),10]=STR$(I9[R3])
4840       PRINT FILE[3],A3$
4850       FOR K=1 TO N
4860         READ FILE[0,N*(N1+5)+(N+1)*(J-1)+1+K],A3$
4870         LET A3$[3,10]="00000000"
4880         LET A3$[11-LEN(STR$(I9[R3])),10]=STR$(I9[R3])
4890         PRINT FILE[3],A3$
4900         FOR L=1 TO 5
4910           READ FILE[1,19*(K-1)+L],A3$
4920           PRINT FILE[3],A3$
4930         NEXT L
4940       NEXT K
4950       LET DB[J]=I9[R3]
4960       LET R3=R3+1

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
```

EPA-287 (Cin.)
(4-76)

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C-O-N-T-I-N-U-O-U-S   F-L-O-W   A-N-A-L-Y-Z-E-R   A-U-T-O   S-Y-S-T-E-M
5/23/1980                                                          PAGE 13
                    PROGRAM LISTING FOR CFA02

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
4970      GOTO 5550
4980      REM  ___________________________________
4990      REM          UNKNOWNS WITH SPIKES AND DUPLICATES
5000      IF A3$[12,14]<>"LDX" THEN GOTO 5250
5010      IF N=1 THEN GOTO 5060
5020      READ FILE[0,N*(N1+5)+(N+1)*(J-1)+1],A3$
5030      LET A3$[3,10]="00000000"
5040      LET A3$[11-LEN(STR$(I9[R3])),10]=STR$(I9[R3])
5050      PRINT FILE[3],A3$
5060      FOR K=1 TO N
5070        READ FILE[0,N*(N1+5)+(N+1)*(J-1)+1+K],A3$
5080        LET A3$[3,10]="00000000"
5090        LET A3$[11-LEN(STR$(I9[R3])),10]=STR$(I9[R3])
5100        PRINT FILE[3],A3$
5110        FOR L=1 TO 5
5120          READ FILE[1,19*(K-1)+L],A3$
5130          PRINT FILE[3],A3$
5140        NEXT L
5150        FOR L=1 TO 4
5160          READ FILE[1,19*(K-1)+15+L],A3$
5170          PRINT FILE[3],A3$
5180        NEXT L
5190      NEXT K
5200      LET D8[J]=I9[R3]
5210      LET R3=R3+1
5220      GOTO 5550
5230      REM  ___________________________________
5240      REM          SPIKES
5250      IF A3$[12,14]<>"LSF" THEN GOTO 5430
5260      LET Z7=VAL(A3$[3,10])
5270      IF N=1 THEN GOTO 5320
5280      READ FILE[0,N*(N1+5)+(N+1)*(J-1)+1],A3$
5290      LET A3$[3,10]="00000000"
5300      LET A3$[11-LEN(STR$(D8[Z7])),10]=STR$(D8[Z7])
5310      PRINT FILE[3],A3$
5320      FOR K=1 TO N
5330        READ FILE[0,N*(N1+5)+(N+1)*(J-1)+1+K],A3$
5340        LET A3$[3,10]="00000000"
5350        LET A3$[11-LEN(STR$(D8[Z7])),10]=STR$(D8[Z7])
5360        PRINT FILE[3],A3$
5370        LET A3$[12,14]="LSA"
5380        PRINT FILE[3],A3$

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
```

```
C-O-N-T-I-N-U-O-U-S   F-L-O-W   A-N-A-L-Y-Z-E-R   A-U-T-O   S-Y-S-T-E-M
5/23/1980                                                          PAGE 14
                    PROGRAM LISTING FOR CFA02

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
5390      NEXT K
5400      GOTO 5550
5410      REM  ___________________________________
5420      REM          DUPLICATES
5430      LET Z7=VAL(A3$[3,10])
5440      IF N=1 THEN GOTO 5490
5450      READ FILE[0,N*(N1+5)+(N+1)*(J-1)+1],A3$
5460      LET A3$[3,10]="00000000"
5470      LET A3$[11-LEN(STR$(D8[Z7])),10]=STR$(D8[Z7])
5480      PRINT FILE[3],A3$
5490      FOR K=1 TO N
5500        READ FILE[0,N*(N1+5)+(N+1)*(J-1)+1+K],A3$
5510        LET A3$[3,10]="00000000"
5520        LET A3$[11-LEN(STR$(D8[Z7])),10]=STR$(D8[Z7])
5530        PRINT FILE[3],A3$
5540      NEXT K
5550    NEXT J
5560    PRINT ".";
5570 NEXT I
5580 REM  ___________________________________
5590 REM          LEFT OVER UNKNOWNS
5600 LET A2$=A1$
5610 LET F8=1
5620 IF N9<>0 THEN LET F8=INT(R4/N9)*N9+1
5630 FOR I=F8 TO R4
5640    IF N=1 THEN GOTO 5690
5650    LET A3$="6 00000000 000 P   000YZNN
                               *
*
5660    LET A3$[11-LEN(STR$(I9[R3])),10]=STR$(I9[R3])
5670    LET A3$[14,14]=STR$(N)
5680    PRINT FILE[3],A3$
5690    FOR J=1 TO N
5700      LET A3$="2 00000000     P   ",A2$[J*7-6,J*7],"              ?G/
                                           *
*  L
5710      LET A3$[11-LEN(STR$(I9[R3])),10]=STR$(I9[R3])
5720      PRINT FILE[3],A3$
5730    NEXT J
5740    LET R3=R3+1
5750 NEXT I
5760 REM  ___________________________________
5770 REM          TRAILING BLANKS
5780 LET A3$="3                  P                 B
                                 *
*

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
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C-O-N-T-I-N-U-O-U-S   F-L-O-W   A-N-A-L-Y-Z-E-R   A-U-T-O   S-Y-S-T-E-M
5/23/1980                                                         PAGE 15
                      PROGRAM LISTING FOR CFA02

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
5790 FOR I=1 TO 4
5800   FOR J=1 TO N
5810     LET A3$[20,26]=A2$[7*J-6,7*J]
5820     PRINT FILE[3],A3$
5830   NEXT J
5840 NEXT I
5850 CLOSE
5860 PRINT "."
5870 NOESC
5880 CHAIN "CFA00"
5890 REM    +++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
5900 REM          SUBROUTINE TO CONVERT NUMBER TO EXPONENTIAL NOTATION
5910 LET N$="+0.000E+00"
5920 IF X=0 THEN GOTO 6110
5930 IF X<0 THEN LET N$[1,1]="-"
5940 LET X=ABS(X)
5950 LET E=0
5960 IF X<.9995 THEN GOTO 6010
5970 IF X<9.9995 THEN GOTO 6040
5980 LET X=X/10
5990 LET E=E+1
6000 GOTO 5960
6010 LET X=X*10
6020 LET E=E-1
6030 GOTO 5960
6040 LET X=X+5E-04
6050 LET N1$=STR$(X)
6060 IF LEN(N1$)>5 THEN LET N1$=N1$[1,5]
6070 LET N$[2,LEN(N1$)+1]=N1$
6080 IF E<0 THEN LET N$[8,8]="-"
6090 LET N1$=STR$(ABS(E))
6100 LET N$[11-LEN(N1$),10]=N1$
6110 RETURN






1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
```

```
C-O-N-T-I-N-U-O-U-S   F-L-O-W   A-N-A-L-Y-Z-E-R   A-U-T-O   S-Y-S-T-E-M
5/23/1980                                                         PAGE 16
                          SYMBOL TABLE FOR CFA02

SYMBOL    REFERENCES
------    ---------------------------------------------------------
 0110     0090  3150
 0140     0100
 0190     0170
 0220     0310  0320  0380
 0270     0210  0510  0910  3160
 0300     0280
 0410     0340
 0470     3230
 0520     0460
 0940     0200  0350
 0990     0970
 1030     1010
 1070     1050
 1110     1020
 1200     1340
 1220     1200
 1260     1230
 1290     1270
 1350     1250  1300  1490
 1370     1350
 1410     1380
 1440     1420
 1500     1400  1450
 1690     1830
 1710     1690
 1750     1720
 1780     1760
 1840     1740  1790  1980
 1860     1840
 1900     1870
 1930     1910
 1990     1890  1940
 2170     2310
 2190     2170
 2230     2200
 2260     2240
 2320     2220  2270  2450
 2340     2320
 2380     2350
 2410     2390
 2460     2370  2420
 2720     2860
 2740     2720
 2780     2750
 2810     2790
```

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```
C-O-N-T-I-N-U-O-U-S   F-L-O-W   A-N-A-L-Y-Z-E-R   A-U-T-O   S-Y-S-T-E-M
5/23/1980                                                           PAGE 17
                        SYMBOL TABLE FOR CFA02

SYMBOL    REFERENCES
______   ________________________________________________________________

 2870    2770  2820
 2920    3060
 2940    2920
 2980    2950
 3010    2990
 3070    2970  3020
 3190    0330
 3260    3240
 3310    3480  3550  3660
 3340    3320
 3380    3360
 3460    3400  3410  3420  3430  3440
 3490    3450
 3560    3510
 3650    3610
 3670    3350  3390  3640
 3730    3710
 3770    3750
 3810    3720
 4070    4010
 4140    4110
 4250    4100
 4290    4260
 4420    4250
 4480    4430
 4580    4420
 4640    4590
 4790    4580
 4850    4800
 5000    4790
 5060    5010
 5250    5000
 5320    5270
 5430    5250
 5490    5440
 5550    4060  4220  4390  4550  4760  4970  5220  5400
 5600    3960
 5690    5640
 5910    1590  2070  2540  2870  3070
 5960    6000  6030
 6010    5960
 6040    5970
 6110    5920
 A$      0080  0290  0310  0320  0330  0340  0350  1210  1230  1280
         1360  1380  1430  1700  1720  1770  1850  1870  1920  2180
```

```
C-O-N-T-I-N-U-O-U-S   F-L-O-W   A-N-A-L-Y-Z-E-R   A-U-T-O   S-Y-S-T-E-M
5/23/1980                                                           PAGE 18
                        SYMBOL TABLE FOR CFA02

SYMBOL    REFERENCES
______   ________________________________________________________________

         2200  2250  2330  2350  2400  2730  2750  2800  2930  2950
         3000
 A1$     0080  0420  0460  0620  0950  1120  1150  3130  3200  3230
         3850  5600
 A2$     0080  1120  1510  5600  5700  5810
 A3$     0080  0450  0460  0690  0710  0800  0820  1510  1600  1610
         1620  1990  2080  2090  2100  2460  2550  2560  2570  2640
         2650  2660  2670  2690  2700  2880  2890  2900  3080  3090
         3100  3220  3230  3810  3820  3870  3880  3910  3920  3990
         4010  4030  4040  4070  4100  4120  4130  4150  4160  4180
         4190  4250  4270  4280  4300  4310  4330  4350  4360  4420
         4440  4450  4460  4470  4490  4500  4510  4520  4580  4600
         4610  4620  4630  4650  4660  4670  4680  4700  4710  4790
         4810  4820  4830  4840  4860  4870  4880  4890  4910  4920
         5000  5020  5030  5040  5050  5070  5080  5090  5100  5120
         5130  5160  5170  5250  5260  5280  5290  5300  5310  5330
         5340  5350  5360  5370  5380  5430  5450  5460  5470  5480
         5500  5510  5520  5530  5650  5660  5670  5680  5700  5710
         5720  5780  5810  5820
 A7$     0080  0600  0710  0780  0820  1500  1610  2090  2560
 A8$     0080  4310  4320
 D8[     0080  4740  4950  5200  5300  5350  5470  5520
 E       5950  5990  6020  6080  6090
 F       1530  1540  1550  1560  1570  1580  2010  2020  2030  2040
         2050  2060  2480  2490  2500  2510  2520  2530
 F8      5610  5620  5630
 F9      3330  3350  3400  3420  3430  3490  3580
 FL#0    0410  0420  0430  0940  0950  0960  3190  3200  3850  3870
         3910  3990  4030  4070  4120  4150  4270  4300  4440  4490
         4600  4650  4810  4860  5020  5070  5280  5330  5450  5500
 FL#1    0440  0450  0690  0800  0900  1000  1620  2100  2570  2670
         2700  2900  3100  3130  3140  3210  3220  4180  4350  4700
         4910  5120  5160
 FL#3    3700  3820  3880  3920  4040  4130  4160  4190  4280  4320
         4330  4360  4470  4520  4630  4680  4710  4840  4890  4920
         5050  5100  5130  5170  5310  5360  5380  5480  5530  5680
         5720  5820
 I       0590  0620  0840  1130  1150  1510  3120  3490  3510  3570
         3580  3590  3650  3860  3870  3890  3900  3910  3930  3970
         5570  5630  5750  5790  5840
 I9[     0080  3510  3590  4460  4510  4620  4670  4740  4830  4880
         4950  5040  5090  5200  5660  5710
 J       0630  0650  0660  0670  0720  0730  0750  0790  0820  0830
         1520  1530  1540  1550  1560  1570  1610  1640  2000  2010
         2020  2030  2040  2050  2090  2120  2470  2480  2490  2500
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C-O-N-T-I-N-U-O-U-S   F-L-O-W   A-N-A-L-Y-Z-E-R   A-U-T-O   S-Y-S-T-E-M
5/23/1980                                                         PAGE 19
                         SYMBOL TABLE FOR CFA02

SYMBOL     REFERENCES
------     ---------------------------------------------------------------
           2510  2520  2560  2590  3500  3510  3560  3980  3990  4030
           4070  4120  4150  4270  4300  4440  4490  4600  4650  4740
           4810  4860  4950  5020  5070  5200  5280  5330  5450  5500
           5550  5690  5700  5730  5800  5810  5830
 K         0680  0710  0740  4020  4030  4050  4140  4150  4180  4210
           4290  4300  4350  4380  4480  4490  4530  4640  4650  4700
           4730  4850  4860  4910  4940  5060  5070  5120  5160  5190
           5320  5330  5390  5490  5500  5540
 L         4170  4180  4200  4340  4350  4370  4690  4700  4720  4900
           4910  4930  5110  5120  5140  5150  5160  5180
 L9        3370  3390  3410  3420  3440  3490  3580
 M1        1240  1260  1280  1300  1580  1730  1750  1770  1790  2060
           2210  2230  2250  2270  2530
 N         0420  0590  0950  1130  3200  3850  3860  3900  3990  4020
           4030  4070  4110  4120  4140  4150  4260  4270  4290  4300
           4430  4440  4480  4490  4590  4600  4640  4650  4800  4810
           4850  4860  5010  5020  5060  5070  5270  5280  5320  5330
           5440  5450  5490  5500  5640  5670  5690  5800
 N$        0080  1600  2080  2550  2880  3080  5910  5930  6070  6080
           6100
 N1        3850  3900  3990  4030  4070  4120  4150  4270  4300  4440
           4490  4600  4650  4810  4860  5020  5070  5280  5330  5450
           5500
 N1$       0080  6050  6060  6070  6090  6100
 N3        3850  3980
 N9        3850  3960  3970  5620
 R         0570  0690  0700  0800  0810  1110  1620  1630  2100  2110
           2570  2580  2670  2680  2700  2710  2900  2910  3100  3110
 R3        3270  3500  3590  3600  3610  3670  3950  4460  4510  4540
           4620  4670  4740  4750  4830  4880  4950  4960  5040  5090
           5200  5210  5660  5710  5740
 R4        3670  3970  5620  5630
 S1        1390  1410  1430  1450  1580  1880  1900  1920  1940  2060
           2360  2380  2400  2420  2530
 X         1580  2060  2530  2760  2780  2800  2820  2960  2980  3000
           3020  5920  5930  5940  5960  5970  5980  6010  6040  6050
 Z7        5260  5300  5350  5430  5470  5520
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SECTION 5

PROGRAM CFA03 - RUN FILE ASSIMILATOR

CFA03 is the program which assimilates into the CFA System a run file which has been produced by either the Sample File Control System or the program CFA02. To "assimilate" a run file means to copy the data from the run file into the reduced data file, CFA003. This program is entered by chaining from the CFA master control program, CFA00, and it chains back to that program if the escape key is pressed.

As the program begins, it checks whether the file 0000000.RF has been created in the current directory by program CFA02. If it has, this program assimilates it. If it has not, this program asks for the name of the run file created by the Sample File Control System and attempts to assimilate it.

As the process of assimilation begins, the program scans the parameter-method codes of the timing set standards to determine the number of analytes. It then checks to be sure that there are three timing set standards, two blanks, and a calibration standard at the beginning of the batch, and it copies them into CFA003. It then checks and copies the remaining calibration standards.

When the program encounters the first record in the run file which does not refer to a calibration standard, it proceeds to the next section. It reads a record from the run file. If that record is a type 6 record, it is ignored, and the program reads the next record. It then branches to one of ten procedures, depending upon the sample type.

If the sample is an unknown with no associated quality control items, the program simply copies the data for the sample into CFA003. The data elements include the sample ID number and the run file record number.

If the sample is an unknown which has a spike (an LS0), the program copies the sample ID number, the run file record number, and the quality control limits for the spike into CFA003.

If the sample is an unknown which has a duplicate (an LD1), the program copies the sample ID number, the run file record number, and the quality control limits for the duplicate into CFA003.

If the sample is an unknown which has a spike and a duplicate (an LDX), the program copies the sample ID number, the run file record number, and the quality control limits for the spike and the duplicate into CFA003.

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If the sample is a spike, (an LSF), the program locates the wheel position of the associated unknown. It then copies that data element, the sample ID number, and the run file record number into CFA003.

If the sample is a duplicate (an LDn), the program locates the wheel position of the associated unknown. It then copies that data element, the sample ID number, and the run file record number into CFA003.

If the sample is a reagent blank, the program copies the run file record number and the quality control limits into CFA003.

If the sample is a check standard, the program locates the wheel position of the associated calibration standard. It then copies that data element and the run file record number into CFA003.

If the sample is a blank, the program simply copies the run file record number into CFA003.

The program then proceeds to the next sample. When the end of the run file is reached, the program checks to be sure that the last four samples of the batch are all blanks. It then chains to CFA04.

If any error is detected in the run file, the user is informed of the problem, the file CFA003 is deleted, and the program chains back to CFA00.

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(4-76)

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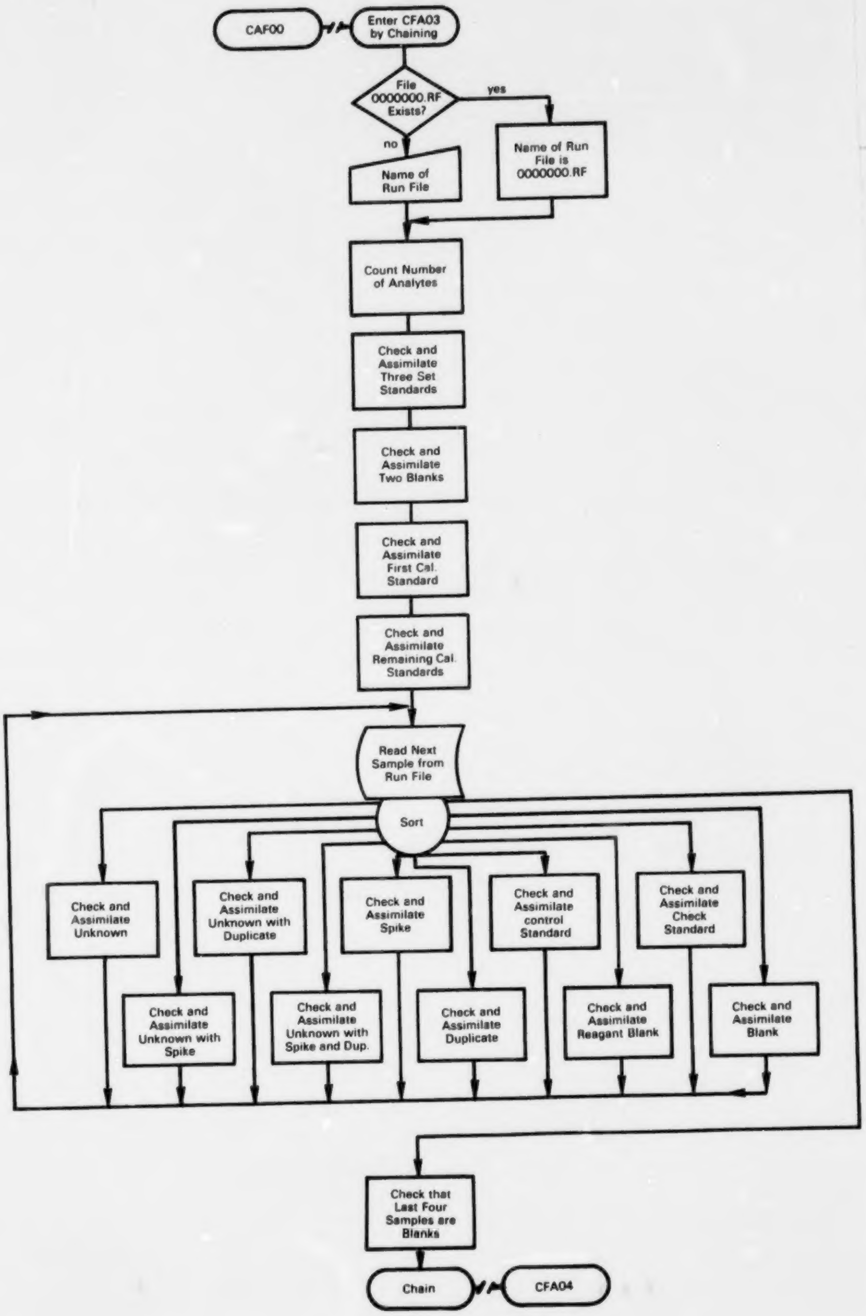
CAF00
Enter CFA03 by Chaining
File 0000000.RF Exists?
yes
no
Name of Run File is 0000000.RF
Name of Run File
Count Number of Analytes
Check and Assimilate Three Set Standards
Check and Assimilate Two Blanks
Check and Assimilate First Cal. Standard
Check and Assimilate Remaining Cal. Standards
Read Next Sample from Run File
Sort
Check and Assimilate Unknown
Check and Assimilate Unknown with Duplicate
Check and Assimilate Spike
Check and Assimilate control Standard
Check and Assimilate Check Standard
Check and Assimilate Unknown with Spike
Check and Assimilate Unknown with Spike and Dup.
Check and Assimilate Duplicate
Check and Assimilate Reagant Blank
Check and Assimilate Blank
Check that Last Four Samples are Blanks
Chain
CFA04

Figure 5. Functional Flowchart for Program CFA03.

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TABLE 4. SYMBOL DEFINITIONS FOR PROGRAM CFA03

A2$	the superstring of parameter-method codes
A3$	the record read from the run file
A7$	the superstring of quality control limit types
C()	the array of data common to all analytes for a wheel position
	C(1) = sample type code where
	1 = timing set standard
	2 = calibration standard
	3.0 = unknown with no associated quality control items
	3.1 = unknown which has a spike (LS0)
	3.2 = unknown which has a duplicate (LD1)
	3.3 = unknown which has a spike and a duplicate (LDX)
	4 = spiked sample
	5.2 = duplicate (LD2)
	5.n = additional duplicate (LDn)
	6 = control standard
	7 = reagent blank
	8 = check standard
	9 = blank
	10 = extra repeat position
	11 = repeat position assigned for an offscale sample or a sample for which the peak height could not be determined
	C(2) = volume before dilution
	C(3) = volume of dilution water
	C(4) = wheel position of associated sample, if any
I	the control variable for loops
J	the control variable for loops
N	the number of analytes
R	the number of the next record to be read from the run file
R9$	the name of the run file
S$	the ID nunber of a sample
S0	the theoretical concentration of a check standard
S()	the array of data specific to one analyte for a wheel position
	S(1) = the raw peak height
	S(2) = the baseline corrected peak height
	S(3) = the upper control limit
	S(4) = the upper warning limit
	S(5) = the average recovery
	S(6) = the lower warning limit
	S(7) = the lower control limit
	S(8) = the A value in control limits for duplicates
	S(9) = the B value
	S(10) = the C value
	S(11) = the D value
	S(12) = the calculated concentration
	S(13) = the theoretical concentration
	S(14) = the associated run file record number
W	the wheel position being assimilated
Z5	the counter for the number of unknowns in the batch

EPA-287 (Cin.)
(4-76)

TYPING GUIDE SHEET
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C-O-N-T-I-N-U-O-U-S   F-L-O-W   A-N-A-L-Y-Z-E-R   A-U-T-O   S-Y-S-T-E-M
5/23/1980                                                      PAGE  1
                  PROGRAM LISTING FOR CFA03

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
0010 REM   +=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+
0020 REM   +   CONTINUOUS FLOW ANALYZER AUTOMATION SYSTEM              +
0030 REM   +   PROGRAM CFA03, RUN FILE ASSIMILATOR                     +
0040 REM   +   BY:  J. KOPKE (UCCC)      JANUARY 18, 1980              +
0050 REM   +   MOST RECENT REVISION:  APRIL 15, 1980                   +
0060 REM   +=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+
0070 REM
0080 DIM A2$[21],A3$[79],A7$[15],C[4],R9$[13],S$[8],S[14]
0090 LET Z5=1
0100 ON ESC THEN GOTO 0130
0110 ESC
0120 GOTO 0190
0130 NOESC
0140 CLOSE
0150 ON ERR THEN GOTO 0170
0160 DELETE "CFA003"
0170 ON ERR THEN STOP
0180 CHAIN "CFA00"
0190 ON ERR THEN GOTO 0210
0200 RENAME "0000000.RF","0000000.RF"
0210 ON ERR THEN STOP
0220 IF SYS(7)=-9 THEN GOTO 0300
0230 PRINT
0240 ON ERR THEN GOTO 0260
0250 INPUT "NAME OF THE SFC RUN FILE >>  ",R9$
0260 ON ERR THEN STOP
0270 IF LEN(R9$)<3 THEN GOTO 0410
0280 IF R9$[LEN(R9$)-2]◇".RF" THEN LET R9$=R9$,".RF"
0290 GOTO 0360
0300 PRINT
0310 ON ERR THEN GOTO 0330
0320 INPUT "NAME OF THE SFC RUN FILE ([NON-SFC],---) >>  ",R9$
0330 ON ERR THEN STOP
0340 IF R9$◇"" THEN GOTO 0280
0350 LET R9$="0000000.RF"
0360 ON ERR THEN GOTO 0400
0370 OPEN FILE[3,3],R9$
0380 ON ERR THEN STOP
0390 GOTO 0440
0400 ON ERR THEN STOP
0410 PRINT
0420 PRINT "<7>THE RUN FILE DOES NOT EXIST"

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
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C-O-N-T-I-N-U-O-U-S   F-L-O-W   A-N-A-L-Y-Z-E-R   A-U-T-O   S-Y-S-T-E-M
5/23/1980                                                      PAGE  2
                  PROGRAM LISTING FOR CFA03

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
0430 GOTO 0130
0440 ON ERR THEN GOTO 0460
0450 DELETE "CFA003"
0460 ON ERR THEN STOP
0470 OPEN FILE[4,0],"CFA003",56
0480 REM    ___________________________________________________________
0490 REM            DETERMINE NUMBER OF ANALYTES
0500 LREAD FILE[3],A3$
0510 IF EOF(3) THEN GOTO 5210
0520 LET R=1
0530 IF A3$[1,1]◇"1" THEN GOTO 5210
0540 LREAD FILE[3],A3$
0550 IF EOF(3) THEN GOTO 5210
0560 IF A3$[1,1]="3" THEN IF A3$[39,40]="T " THEN GOTO 0610
0570 PRINT
0580 PRINT "<7>THE RUN FILE CANNOT BE USED BECAUSE IT DOES NOT BEGIN W
*     ITH THREE "
0590 PRINT "TIMING SET STANDARDS"
0600 GOTO 0130
0610 LET A2$[1,7]=A3$[20,26]
0620 LET N=1
0630 LREAD FILE[3],A3$
0640 IF EOF(3) THEN GOTO 5210
0650 IF A3$[1,1]="3" THEN IF A3$[39,40]="T " THEN GOTO 0670
0660 GOTO 0570
0670 IF A3$[20,26]=A2$[1,7] THEN GOTO 0850
0680 LET N=2
0690 LET A2$[8,14]=A3$[20,26]
0700 LREAD FILE[3],A3$
0710 IF EOF(3) THEN GOTO 5210
0720 IF A3$[1,1]="3" THEN IF A3$[39,40]="T " THEN GOTO 0740
0730 GOTO 0570
0740 IF A3$[20,26]=A2$[1,7] THEN GOTO 0850
0750 LET N=3
0760 LET A2$[15,21]=A3$[20,26]
0770 LREAD FILE[3],A3$
0780 IF EOF(3) THEN GOTO 5210
0790 IF A3$[1,1]="3" THEN IF A3$[39,40]="T" THEN IF A3$[20,26]◇A2$[1,
*     7] THEN GOTO 0810
0800 GOTO 0850
0810 PRINT
0820 PRINT "<7>THE RUN FILE CANNOT BE USED BECAUSE IT INCLUDES MORE TH
*     AN "

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
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EPA-287 (Cin.)
(4-76)
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C-O-N-T-I-N-U-O-U-S   F-L-O-W   A-N-A-L-Y-Z-E-R   A-U-T-O   S-Y-S-T-E-M
5/23/1980                                                       PAGE  3
                          PROGRAM LISTING FOR CFA03

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
0830 PRINT "THREE ANALYTES"
0840 GOTO 0130
0850 CLOSE FILE[3]
0860 OPEN FILE[3,3],R9$
0870 LET R=0
0880 LREAD FILE[3],A3$
0890 IF EOF(3) THEN GOTO 5210
0900 LET R=R+1
0910 REM ____________________________________________________________
0920 REM           CHECK FOR AND COPY THREE SET STANDARDS
0930 LET C[1]=1
0940 LET C[2]=1
0950 LET C[3]=0
0960 LET C[4]=0
0970 LET S$="                    "
0980 MAT S=ZER
0990 FOR W=1 TO 3
1000    WRITE FILE[4,(W-1)*(N+1)+1],C[1],C[2],C[3],C[4],S$
1010    FOR I=1 TO N
1020      LREAD FILE[3],A3$
1030       IF EOF(3) THEN GOTO 5210
1040       LET R=R+1
1050       IF A3$[1,1]="3" THEN IF A3$[39,40]="T " THEN GOTO 1070
1060       GOTO 0570
1070       LET S[14]=R
1080       MAT WRITE FILE[4,(W-1)*(N+1)+1+I],S
1090    NEXT I
1100 NEXT W
1110 REM ____________________________________________________________
1120 REM           CHECK FOR AND COPY TWO BLANKS
1130 LET C[1]=9
1140 FOR W=4 TO 5
1150    WRITE FILE[4,(W-1)*(N+1)+1],C[1],C[2],C[3],C[4],S$
1160    FOR I=1 TO N
1170      LREAD FILE[3],A3$
1180       IF EOF(3) THEN GOTO 5210
1190       LET R=R+1
1200       IF A3$[1,1]="3" THEN IF A3$[39,40]="B " THEN GOTO 1250
1210       PRINT
1220       PRINT "<7>THE RUN FILE CANNOT BE USED BECAUSE IT DOES NOT HAV
*   E TWO BLANKS"
 1230      PRINT "BETWEEN THE TIMING SET STANDARDS AND THE CALIBRATION S
*   TANDARDS"

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
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```
C-O-N-T-I-N-U-O-U-S   F-L-O-W   A-N-A-L-Y-Z-E-R   A-U-T-O   S-Y-S-T-E-M
5/23/1980                                                       PAGE  4
                          PROGRAM LISTING FOR CFA03

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
1240       GOTO 0130
1250       LET S[14]=R
1260       MAT WRITE FILE[4,(W-1)*(N+1)+1+I],S
1270    NEXT I
1280 NEXT W
1290 REM ____________________________________________________________
1300 REM           CHECK FOR AND COPY FIRST CALIBRATION STANDARD
1310 LET W=6
1320 LET C[1]=2
1330 WRITE FILE[4,(W-1)*(N+1)+1],C[1],C[2],C[3],C[4],S$
1340 FOR I=1 TO N
1350    LREAD FILE[3],A3$
1360    IF EOF(3) THEN GOTO 5210
1370    LET R=R+1
1380    IF A3$[1,1]="3" THEN IF A3$[39,40]="S " THEN GOTO 1440
1390    PRINT
1400    PRINT "<7>THE RUN FILE CANNOT BE USED BECAUSE THERE ARE NO CALI
*   BRATION"
 1410   PRINT "STANDARDS IMMEDIATELY AFTER THE THREE TIMING SET STANDAR
*   DS AND"
1420    PRINT "TWO BLANKS"
1430    GOTO 0130
1440    ON ERR THEN GOTO 5210
1450    LET S[13]=VAL(A3$[5,14])
1460    ON ERR THEN STOP
1470    LET S[14]=R
1480    MAT WRITE FILE[4,(W-1)*(N+1)+1+I],S
1490 NEXT I
1500 REM ____________________________________________________________
1510 REM           COPY REST OF CALIBRATION STANDARDS
1520 LET W=7
1530 LREAD FILE[3],A3$
1540 IF EOF(3) THEN GOTO 5210
1550 LET R=R+1
1560 IF A3$[1,1]="3" THEN IF A3$[39,40]="S " THEN GOTO 1580
1570 GOTO 1790
1580 WRITE FILE[4,(W-1)*(N+1)+1],C[1],C[2],C[3],C[4],S$
1590 FOR I=1 TO N
1600    IF I=1 THEN GOTO 1660
1610    LREAD FILE[3],A3$
1620    IF EOF(3) THEN GOTO 5210
1630    LET R=R+1

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
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```
C-O-N-T-I-N-U-O-U-S  F-L-O-W  A-N-A-L-Y-Z-E-R  A-U-T-O  S-Y-S-T-E-M
5/23/1980                                                    PAGE  5
                    PROGRAM LISTING FOR CFA03

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
1640   IF A3$[1,1]="3" THEN IF A3$[39,40]="S " THEN GOTO 1660
1650   GOTO 5210
1660   ON ERR THEN GOTO 5210
1670   LET S[13]=VAL(A3$[5,14])
1680   ON ERR THEN STOP
1690   LET S[14]=R
1700   MAT WRITE FILE[4,(W-1)*(N+1)+1+I],S
1710 NEXT I
1720 LET W=W+1
1730 GOTO 1530
1740 REM  ______________________________________________________________
1750 REM            SORT BY SAMPLE TYPE
1760 LREAD FILE[3],A3$
1770 IF EOF(3) THEN GOTO 5060
1780 LET R=R+1
1790 IF A3$[1,1]="6" THEN GOTO 1760
1800 IF A3$[1,1]<>"2" THEN GOTO 1900
1810 IF A3$[12,14]="   " THEN GOTO 1960
1820 IF A3$[12,14]="LSO" THEN GOTO 2160
1830 IF A3$[12,14]="LD1" THEN GOTO 2480
1840 IF A3$[12,14]="LDX" THEN GOTO 2800
1850 IF A3$[12,14]="LSF" THEN GOTO 3240
1860 IF A3$[12,13]="LD" THEN GOTO 3560
1870 IF A3$[12,14]="LCM" THEN GOTO 3820
1880 IF A3$[12,14]="LRB" THEN GOTO 4200
1890 GOTO 5210
1900 IF A3$[1,1]<>"3" THEN GOTO 5210
1910 IF A3$[39,40]="CS" THEN GOTO 4510
1920 IF A3$[39,40]="B " THEN GOTO 4870
1930 GOTO 5210
1940 REM  ______________________________________________________________
1950 REM            COPY UNKNOWNS
1960 LET C[1]=3
1970 LET C[4]=0
1980 LET S$=A3$[3,10]
1990 WRITE FILE[4,(W-1)*(N+1)+1],C[1],C[2],C[3],C[4],S$
2000 MAT S=ZER
2010 FOR I=1 TO N
2020   IF I=1 THEN GOTO 2080
2030   LREAD FILE[3],A3$
2040   IF EOF(3) THEN GOTO 5210
2050   LET R=R+1

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
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C-O-N-T-I-N-U-O-U-S  F-L-O-W  A-N-A-L-Y-Z-E-R  A-U-T-O  S-Y-S-T-E-M
5/23/1980                                                    PAGE  6
                    PROGRAM LISTING FOR CFA03

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
2060   IF A3$[1,1]="2" THEN IF A3$[12,14]="   " THEN GOTO 2080
2070   GOTO 5210
2080   LET S[14]=R
2090   MAT WRITE FILE[4,(W-1)*(N+1)+1+I],S
2100 NEXT I
2110 GOSUB 5270
2120 LET W=W+1
2130 GOTO 1760
2140 REM  ______________________________________________________________
2150 REM            COPY UNKNOWNS WITH SPIKES
2160 LET C[1]=3.1
2170 LET C[4]=0
2180 LET S$=A3$[3,10]
2190 WRITE FILE[4,(W-1)*(N+1)+1],C[1],C[2],C[3],C[4],S$
2200 MAT S=ZER
2210 FOR I=1 TO N
2220   IF I=1 THEN GOTO 2280
2230   LREAD FILE[3],A3$
2240   IF EOF(3) THEN GOTO 5210
2250   LET R=R+1
2260   IF A3$[1,1]="2" THEN IF A3$[12,14]="LSO" THEN GOTO 2280
2270   GOTO 5210
2280   LET S[14]=R
2290   LET A7$="UCLUMLAVELWLLCL"
2300   FOR J=1 TO 5
2310     LREAD FILE[3],A3$
2320     IF EOF(3) THEN GOTO 5210
2330     LET R=R+1
2340     IF A3$[1,1]<>"4" THEN GOTO 5210
2350     IF A3$[3,6]<>"LSPK" THEN GOTO 5210
2360     IF A3$[12,14]<>A7$[J*3-2,J*3] THEN GOTO 5210
2370     ON ERR THEN GOTO 5210
2380     LET S[2+J]=VAL(A3$[28,37])
2390     ON ERR THEN STOP
2400   NEXT J
2410   MAT WRITE FILE[4,(W-1)*(N+1)+1+I],S
2420 NEXT I
2430 GOSUB 5270
2440 LET W=W+1
2450 GOTO 1760
2460 REM  ______________________________________________________________
2470 REM            COPY UNKNOWNS WITH DUPLICATES

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
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EPA-287 (Cin.)
(4-76)

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PROGRAM LISTING FOR CFA03

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123456789112345678921234567893123456789412345678951234567896123456789 7
         0         0         0         0         0         0         0
2480 LET C[1]=3.2
2490 LET C[4]=0
2500 LET S$=A3$[3,10]
2510 WRITE FILE[4,(W-1)*(N+1)+1],C[1],C[2],C[3],C[4],S$
2520 MAT S=ZER
2530 FOR I=1 TO N
2540   IF I=1 THEN GOTO 2600
2550   LREAD FILE[3],A3$
2560   IF EOF(3) THEN GOTO 5210
2570   LET R=R+1
2580   IF A3$[1,1]="2" THEN IF A3$[12,14]="LD1" THEN GOTO 2600
2590   GOTO 5210
2600   LET S[14]=R
2610   LET A7$="ABCD"
2620   FOR J=1 TO 4
2630     LREAD FILE[3],A3$
2640     IF EOF(3) THEN GOTO 5210
2650     LET R=R+1
2660     IF A3$[1,1]<>"4" THEN GOTO 5210
2670     IF A3$[3,6]<>"LDUP" THEN GOTO 5210
2680     IF A3$[12,12]<>A7$[J,J] THEN GOTO 5210
2690     ON ERR THEN GOTO 5210
2700     LET S[7+J]=VAL(A3$[28,37])
2710     ON ERR THEN STOP
2720   NEXT J
2730   MAT WRITE FILE[4,(W-1)*(N+1)+1+I],S
2740 NEXT I
2750 GOSUB 5270
2760 LET W=W+1
2770 GOTO 1760
2780 REM    ____________________________________________________________
2790 REM          COPY UNKNOWNS WITH SPIKES AND DUPLICATES
2800 LET C[1]=3.3
2810 LET C[4]=0
2820 LET S$=A3$[3,10]
2830 WRITE FILE[4,(W-1)*(N+1)+1],C[1],C[2],C[3],C[4],S$
2840 MAT S=ZER
2850 FOR I=1 TO N
2860   IF I=1 THEN GOTO 2920
2870   LREAD FILE[3],A3$
2880   IF EOF(3) THEN GOTO 5210
2890   LET R=R+1

123456789112345678921234567893123456789412345678951234567896123456789 7
         0         0         0         0         0         0         0
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PROGRAM LISTING FOR CFA03

```
123456789112345678921234567893123456789412345678951234567896123456789 7
         0         0         0         0         0         0         0
2900   IF A3$[1,1]="2" THEN IF A3$[12,14]="LDX" THEN GOTO 2920
2910   GOTO 5210
2920   LET S[14]=R
2930   LET A7$="UCLUWLAVELWLLCL"
2940   FOR J=1 TO 5
2950     LREAD FILE[3],A3$
2960     IF EOF(3) THEN GOTO 5210
2970     LET R=R+1
2980     IF A3$[1,1]<>"4" THEN GOTO 5210
2990     IF A3$[3,6]<>"LSPK" THEN GOTO 5210
3000     IF A3$[12,14]<>A7$[J*3-2,J*3] THEN GOTO 5210
3010     ON ERR THEN GOTO 5210
3020     LET S[2+J]=VAL(A3$[28,37])
3030     ON ERR THEN STOP
3040   NEXT J
3050   LET A7$="ABCD"
3060   FOR J=1 TO 4
3070     LREAD FILE[3],A3$
3080     IF EOF(3) THEN GOTO 5210
3090     LET R=R+1
3100     IF A3$[1,1]<>"4" THEN GOTO 5210
3110     IF A3$[3,6]<>"LDUP" THEN GOTO 5210
3120     IF A3$[12,12]<>A7$[J,J] THEN GOTO 5210
3130     ON ERR THEN GOTO 5210
3140     LET S[7+J]=VAL(A3$[28,37])
3150     ON ERR THEN STOP
3160   NEXT J
3170   MAT WRITE FILE[4,(W-1)*(N+1)+1+I],S
3180 NEXT I
3190 GOSUB 5270
3200 LET W=W+1
3210 GOTO 1760
3220 REM    ____________________________________________________________
3230 REM          COPY SPIKES
3240 FOR I=W-1 TO 7 STEP -1
3250   READ FILE[4,(I-1)*(N+1)+1],C[1],C[2],C[3],C[4],S$
3260   IF S$<>A3$[3,10] THEN GOTO 3290
3270   IF C[1]=3.1 THEN GOTO 3310
3280   IF C[1]=3.3 THEN GOTO 3310
3290 NEXT I
3300 GOTO 5210
3310 LET C[1]=4

123456789112345678921234567893123456789412345678951234567896123456789 7
         0         0         0         0         0         0         0
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(4-76)

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C-O-N-T-I-N-U-O-U-S   F-L-O-W   A-N-A-L-Y-Z-E-R   A-U-T-O   S-Y-S-T-E-M
5/23/1980                                                          PAGE  9
                         PROGRAM LISTING FOR CFA03

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
3320 LET C[4]=I
3330 LET S$=A3$[3,10]
3340 WRITE FILE[4,(W-1)*(N+1)+1],C[1],C[2],C[3],C[4],S$
3350 MAT S=ZER
3360 FOR I=1 TO N
3370   IF I=1 THEN GOTO 3430
3380   LREAD FILE[3],A3$
3390   IF EOF(3) THEN GOTO 5210
3400   LET R=R+1
3410   IF A3$[1,1]="2" THEN IF A3$[12,14]="LSF" THEN GOTO 3430
3420   GOTO 5210
3430   LET S[14]=R
3440   LET S[13]=-99999
3450   MAT WRITE FILE[4,(W-1)*(N+1)+1+I],S
3460   LREAD FILE[3],A3$
3470   IF EOF(3) THEN GOTO 5210
3480   LET R=R+1
3490   IF A3$[1,1]="2" THEN IF A3$[12,14]="LSA" THEN GOTO 3510
3500   GOTO 5210
3510 NEXT I
3520 LET W=W+1
3530 GOTO 1760
3540 REM  -------------------------------------------------------
3550 REM          COPY DUPLICATES
3560 FOR I=W-1 TO 7 STEP -1
3570   READ FILE[4,(I-1)*(N+1)+1],C[1],C[2],C[3],C[4],S$
3580   IF S$<>A3$[3,10] THEN GOTO 3610
3590   IF C[1]=3.2 THEN GOTO 3630
3600   IF C[1]=3.3 THEN GOTO 3630
3610 NEXT I
3620 GOTO 5210
3630 LET C[1]=5+VAL(A3$[14,14])/10
3640 LET C[4]=I
3650 LET S$=A3$[3,10]
3660 WRITE FILE[4,(W-1)*(N+1)+1],C[1],C[2],C[3],C[4],S$
3670 MAT S=ZER
3680 FOR I=1 TO N
3690   IF I=1 THEN GOTO 3750
3700   LREAD FILE[3],A3$
3710   IF EOF(3) THEN GOTO 5210
3720   LET R=R+1
3730   IF A3$[1,1]="2" THEN IF A3$[12,13]="LD" THEN GOTO 3750

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
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C-O-N-T-I-N-U-O-U-S   F-L-O-W   A-N-A-L-Y-Z-E-R   A-U-T-O   S-Y-S-T-E-M
5/23/1980                                                          PAGE 10
                         PROGRAM LISTING FOR CFA03

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
3740   GOTO 5210
3750   LET S[14]=R
3760   MAT WRITE FILE[4,(W-1)*(N+1)+1+I],S
3770 NEXT I
3780 LET W=W+1
3790 GOTO 1760
3800 REM  -------------------------------------------------------
3810 REM          COPY CONTROL STANDARDS
3820 LET C[1]=6
3830 LET C[4]=0
3840 LET S$="        "
3850 WRITE FILE[4,(W-1)*(N+1)+1],C[1],C[2],C[3],C[4],S$
3860 MAT S=ZER
3870 FOR I=1 TO N
3880   IF I=1 THEN GOTO 3940
3890   LREAD FILE[3],A3$
3900   IF EOF(3) THEN GOTO 5210
3910   LET R=R+1
3920   IF A3$[1,1]="2" THEN IF A3$[12,14]="LCM" THEN GOTO 3940
3930   GOTO 5210
3940   LREAD FILE[3],A3$
3950   IF EOF(3) THEN GOTO 5210
3960   LET R=R+1
3970   IF A3$[1,1]="2" THEN IF A3$[12,14]="LCT" THEN GOTO 3990
3980   GOTO 5210
3990   ON ERR THEN GOTO 5210
4000   LET S[13]=VAL(A3$[28,37])
4010   LET S[14]=R-1
4020   LET A7$="UCLUMLAVELWLLCL"
4030   FOR J=1 TO 5
4040     LREAD FILE[3],A3$
4050     IF EOF(3) THEN GOTO 5210
4060     LET R=R+1
4070     IF A3$[1,1]<>"4" THEN GOTO 5210
4080     IF A3$[3,6]<>"LCST" THEN GOTO 5210
4090     IF A3$[12,14]<>A7$[J*3-2,J*3] THEN GOTO 5210
4100     ON ERR THEN GOTO 5210
4110     LET S[2+J]=VAL(A3$[28,37])
4120     ON ERR THEN STOP
4130   NEXT J
4140   MAT WRITE FILE[4,(W-1)*(N+1)+1+I],S
4150 NEXT I

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
```

```
C-O-N-T-I-N-U-O-U-S  F-L-O-W  A-N-A-L-Y-Z-E-R  A-U-T-O  S-Y-S-T-E-M
5/23/1980                                                    PAGE 11
                    PROGRAM LISTING FOR CFA03

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
4160 LET W=W+1
4170 GOTO 1760
4180 REM ----------------------------------------------------------------
4190 REM            COPY REAGENT BLANKS
4200 LET C[1]=7
4210 LET C[4]=0
4220 LET S$="          "
4230 WRITE FILE[4,(W-1)*(N+1)+1],C[1],C[2],C[3],C[4],S$
4240 MAT S=ZER
4250 FOR I=1 TO N
4260   IF I=1 THEN GOTO 4320
4270   LREAD FILE[3],A3$
4280   IF EOF(3) THEN GOTO 5210
4290   LET R=R+1
4300   IF A3$[1,1]="2" THEN IF A3$[12,14]="LRB" THEN GOTO 4320
4310   GOTO 5210
4320   LET S[14]=R
4330   LET A7$="UCLUMLAVELWLLCL"
4340   FOR J=1 TO 5
4350     LREAD FILE[3],A3$
4360     IF EOF(3) THEN GOTO 5210
4370     LET R=R+1
4380     IF A3$[1,1]<>"4" THEN GOTO 5210
4390     IF A3$[3,6]<>"LRBL" THEN GOTO 5210
4400     IF A3$[12,14]<>A7$[J*3-2,J*3] THEN GOTO 5210
4410     ON ERR THEN GOTO 5210
4420     LET S[2+J]=VAL(A3$[28,37])
4430     ON ERR THEN STOP
4440   NEXT J
4450   MAT WRITE FILE[4,(W-1)*(N+1)+1+I],S
4460 NEXT I
4470 LET W=W+1
4480 GOTO 1760
4490 REM ----------------------------------------------------------------
4500 REM            COPY CHECK STANDARDS
4510 ON ERR THEN GOTO 5210
4520 LET S0=VAL(A3$[5,14])
4530 ON ERR THEN STOP
4540 FOR I=6 TO 30
4550   READ FILE[4,(I-1)*(N+1)+1],C[1]
4560   IF C[1]<>2 THEN GOTO 5210
4570   MAT READ FILE[4,(I-1)*(N+1)+2],S

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
```

```
C-O-N-T-I-N-U-O-U-S  F-L-O-W  A-N-A-L-Y-Z-E-R  A-U-T-O  S-Y-S-T-E-M
5/23/1980                                                    PAGE 12
                    PROGRAM LISTING FOR CFA03

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
4580   IF S0=S[13] THEN GOTO 4640
4590 NEXT I
4600 PRINT
4610 PRINT "<7>THE RUN FILE CANNOT BE USED BECAUSE IT CONTAINS A CHECK
*       STANDARD WHICH"
4620 PRINT "DOES NOT MATCH ANY OF THE CALIBRATION STANDARDS"
4630 GOTO 0130
4640 LET C[1]=8
4650 LET C[4]=I
4660 LET S$="          "
4670 WRITE FILE[4,(W-1)*(N+1)+1],C[1],C[2],C[3],C[4],S$
4680 FOR I=1 TO N
4690   IF I=1 THEN GOTO 4750
4700   LREAD FILE[3],A3$
4710   IF EOF(3) THEN GOTO 5210
4720   LET R=R+1
4730   IF A3$[1,1]="3" THEN IF A3$[39,40]="CS" THEN GOTO 4750
4740   GOTO 5210
4750   ON ERR THEN GOTO 5210
4760   LET S0=VAL(A3$[5,14])
4770   ON ERR THEN STOP
4780   MAT READ FILE[4,(C[4]-1)*(N+1)+1+I],S
4790   IF S0<>S[13] THEN GOTO 5210
4800   LET S[14]=R
4810   MAT WRITE FILE[4,(W-1)*(N+1)+1+I],S
4820 NEXT I
4830 LET W=W+1
4840 GOTO 1760
4850 REM ----------------------------------------------------------------
4860 REM            COPY BLANKS
4870 LET C[1]=9
4880 LET C[4]=0
4890 LET S$="          "
4900 WRITE FILE[4,(W-1)*(N+1)+1],C[1],C[2],C[3],C[4],S$
4910 MAT S=ZER
4920 FOR I=1 TO N
4930   IF I=1 THEN GOTO 4990
4940   LREAD FILE[3],A3$
4950   IF EOF(3) THEN GOTO 5210
4960   LET R=R+1
4970   IF A3$[1,1]="3" THEN IF A3$[39,40]="B " THEN GOTO 4990
4980   GOTO 5210

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
```

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C-O-N-T-I-N-U-O-U-S  F-L-O-W  A-N-A-L-Y-Z-E-R  A-U-T-O  S-Y-S-T-E-M
5/23/1980                                                     PAGE 13
                     PROGRAM LISTING FOR CFA03

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
4990   LET S[14]=R
5000   MAT WRITE FILE[4,(W-1)*(N+1)+1+I],S
5010 NEXT I
5020 LET W=W+1
5030 GOTO 1760
5040 REM  ------------------------------------------------------------
5050 REM          CHECK FOR FOUR TRAILING BLANKS
5060 FOR I=W-1 TO W-4 STEP -1
5070   READ FILE[4,(I-1)*(N+1)+1],C[1]
5080   IF C[1]<>9 THEN GOTO 5160
5090 NEXT I
5100 WRITE FILE[4,0],N,A2$,R9$,W-1
5110 PRINT
5120 PRINT
5130 NOESC
5140 CLOSE FILE[3]
5150 CHAIN "CFA04"
5160 PRINT
5170 PRINT "<7>THE RUN FILE CANNOT BE USED BECAUSE IT DOES NOT END WIT
*     H FOUR BLANKS"
5180 GOTO 0130
5190 REM  ------------------------------------------------------------
5200 REM          GENERAL RUN FILE ERROR TRAP
5210 ON ERR THEN STOP
5220 PRINT
5230 PRINT "<7>THE RUN FILE CANNOT BE USED BECAUSE IT HAS AN ERROR AT
*     RECORD";R
5240 GOTO 0130
5250 REM  ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
5260 REM          USER CONFIDENCE SUBROUTINE
5270 IF Z5<>1 THEN GOTO 5350
5280 PRINT
5290 PRINT "LOCATION OF UNKNOWNS:"
5300 PRINT
5310 PRINT "WHEEL          WHEEL          WHEEL          WHEEL
*     WHEEL"
5320 PRINT " POS    ID      POS    ID      POS    ID      POS    ID
*      POS    ID"
5330 PRINT " --- --------   --- --------   --- --------   --- --------
*      --- --------"
5340 PRINT " ";
5350 LET A3$="000 ########"

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
```

```
C-O-N-T-I-N-U-O-U-S  F-L-O-W  A-N-A-L-Y-Z-E-R  A-U-T-O  S-Y-S-T-E-M
5/23/1980                                                     PAGE 14
                     PROGRAM LISTING FOR CFA03

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
5360 LET A3$[4-LEN(STR$(W)),3]=STR$(W)
5370 PRINT USING A3$,S$;
5380 IF Z5/5=INT(Z5/5) THEN GOTO 5410
5390 PRINT "    ";
5400 GOTO 5430
5410 PRINT
5420 PRINT " ";
5430 LET Z5=Z5+1
5440 RETURN

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
```

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C-O-N-T-I-N-U-O-U-S   F-L-O-W   A-N-A-L-Y-Z-E-R   A-U-T-O   S-Y-S-T-E-M
5/23/1980                                                          PAGE 15
                       SYMBOL TABLE FOR CFA03

SYMBOL    REFERENCES
------   ---------------------------------------------------------------

 0130   0100  0430  0600  0840  1240  1430  4630  5180  5240
 0170   0150
 0190   0120
 0210   0190
 0260   0240
 0280   0340
 0300   0220
 0330   0310
 0360   0290
 0400   0360
 0410   0270
 0440   0390
 0460   0440
 0570   0660  0730  1060
 0610   0560
 0670   0650
 0740   0720
 0810   0790
 0850   0670  0740  0800
 1070   1050
 1250   1200
 1440   1380
 1530   1730
 1580   1560
 1660   1600  1640
 1760   1790  2130  2450  2770  3210  3530  3790  4170  4480  4840
        5030
 1790   1570
 1900   1800
 1960   1810
 2080   2020  2060
 2160   1820
 2280   2220  2260
 2480   1830
 2600   2540  2580
 2800   1840
 2920   2860  2900
 3240   1850
 3290   3260
 3310   3270  3280
 3430   3370  3410
 3510   3490
 3560   1860
 3610   3580
 3630   3590  3600
```

```
C-O-N-T-I-N-U-O-U-S   F-L-O-W   A-N-A-L-Y-Z-E-R   A-U-T-O   S-Y-S-T-E-M
5/23/1980                                                          PAGE 16
                       SYMBOL TABLE FOR CFA03

SYMBOL    REFERENCES
------   ---------------------------------------------------------------

 3750   3690  3730
 3820   1870
 3940   3880  3920
 3990   3970
 4200   1880
 4320   4260  4300
 4510   1910
 4640   4580
 4750   4690  4730
 4870   1920
 4990   4930  4970
 5060   1770
 5160   5080
 5210   0510  0530  0550  0640  0710  0780  0890  1030  1180  1360
        1440  1540  1620  1650  1660  1890  1900  1930  2040  2070
        2240  2270  2320  2340  2350  2360  2370  2560  2590  2640
        2660  2670  2680  2690  2880  2910  2960  2980  2990  3000
        3010  3080  3100  3110  3120  3130  3300  3390  3420  3470
        3500  3620  3710  3740  3900  3930  3950  3980  3990  4050
        4070  4080  4090  4100  4280  4310  4360  4380  4390  4400
        4410  4510  4560  4710  4740  4750  4790  4950  4980
 5270   2110  2430  2750  3190
 5350   5270
 5410   5380
 5430   5400
 A2$    0080  0610  0670  0690  0740  0760  0790  5100
 A3$    0080  0500  0530  0540  0560  0610  0630  0650  0670  0690
        0700  0720  0740  0760  0770  0790  0880  1020  1050  1170
        1200  1350  1380  1450  1530  1560  1610  1640  1670  1760
        1790  1800  1810  1820  1830  1840  1850  1860  1870  1880
        1900  1910  1920  1980  2030  2060  2180  2230  2260  2310
        2340  2350  2360  2380  2500  2550  2580  2630  2660  2670
        2680  2700  2820  2870  2900  2950  2980  2990  3000  3020
        3070  3100  3110  3120  3140  3260  3330  3380  3410  3460
        3490  3580  3630  3650  3700  3730  3890  3920  3940  3970
        4000  4040  4070  4080  4090  4110  4270  4300  4350  4380
        4390  4400  4420  4520  4700  4730  4760  4940  4970  5350
        5360  5370
 A7$    0080  2290  2360  2610  2680  2930  3000  3050  3120  4020
        4090  4330  4400
 CI     0080  0930  0940  0950  0960  1000  1130  1150  1320  1330
        1580  1960  1970  1990  2160  2170  2190  2480  2490  2510
        2800  2810  2830  3250  3270  3280  3310  3320  3340  3570
        3590  3600  3630  3640  3660  3820  3830  3850  4200  4210
        4230  4550  4560  4640  4650  4670  4780  4870  4880  4900
```

```
C-O-N-T-I-N-U-O-U-S   F-L-O-W   A-N-A-L-Y-Z-E-R   A-U-T-O   S-Y-S-T-E-M
5/23/1980                                                          PAGE 17
                        SYMBOL TABLE FOR CFA03

SYMBOL    REFERENCES
------    ------------------------------------------------------------------
          5070  5080
FL#3      0370  0500  0540  0630  0700  0770  0850  0860  0880  1020
          1170  1350  1530  1610  1760  2030  2230  2310  2550  2630
          2870  2950  3070  3380  3460  3700  3890  3940  4040  4270
          4350  4700  4940  5140
FL#4      0470  1000  1080  1150  1260  1330  1480  1580  1700  1990
          2090  2190  2410  2510  2730  2830  3170  3250  3340  3450
          3570  3660  3760  3850  4140  4230  4450  4550  4570  4670
          4780  4810  4900  5000  5070  5100
I         1010  1080  1090  1160  1260  1270  1340  1480  1490  1590
          1600  1700  1710  2010  2020  2090  2100  2210  2220  2410
          2420  2530  2540  2730  2740  2850  2860  3170  3180  3240
          3250  3290  3320  3360  3370  3450  3510  3560  3570  3610
          3640  3680  3690  3760  3770  3870  3880  4140  4150  4250
          4260  4450  4460  4540  4550  4570  4590  4650  4680  4690
          4780  4810  4820  4920  4930  5000  5010  5060  5070  5090
J         2300  2360  2380  2400  2620  2680  2700  2720  2940  3000
          3020  3040  3060  3120  3140  3160  4030  4090  4110  4130
          4340  4400  4420  4440
N         0620  0680  0750  1000  1010  1080  1150  1160  1260  1330
          1340  1480  1580  1590  1700  1990  2010  2090  2190  2210
          2410  2510  2530  2730  2830  2850  3170  3250  3340  3360
          3450  3570  3660  3680  3760  3850  3870  4140  4230  4250
          4450  4550  4570  4670  4680  4780  4810  4900  4920  5000
          5070  5100
R         0520  0870  0900  1040  1070  1190  1250  1370  1470  1550
          1630  1690  1780  2050  2080  2250  2280  2330  2570  2600
          2650  2890  2920  2970  3090  3400  3430  3480  3720  3750
          3910  3960  4010  4060  4290  4320  4370  4720  4800  4960
          4990  5230
R9$       0080  0250  0270  0280  0320  0340  0350  0370  0860  5100
S         0980  1080  1260  1480  1700  2000  2090  2200  2410  2520
          2730  2840  3170  3350  3450  3670  3760  3860  4140  4240
          4450  4570  4780  4810  4910  5000
S$        0080  0970  1000  1150  1330  1580  1980  1990  2180  2190
          2500  2510  2820  2830  3250  3260  3330  3340  3570  3580
          3650  3660  3840  3850  4220  4230  4660  4670  4890  4900
          5370
S0        4520  4580  4760  4790
SI        0080  1070  1250  1450  1470  1670  1690  2080  2280  2380
          2600  2700  2920  3020  3140  3430  3440  3750  4000  4010
          4110  4320  4420  4580  4790  4800  4990
W         0990  1000  1080  1100  1140  1150  1260  1280  1310  1330
          1480  1520  1580  1700  1720  1990  2090  2120  2190  2410
          2440  2510  2730  2760  2830  3170  3200  3240  3340  3450
```

```
C-O-N-T-I-N-U-O-U-S   F-L-O-W   A-N-A-L-Y-Z-E-R   A-U-T-O   S-Y-S-T-E-M
5/23/1980                                                          PAGE 18
                        SYMBOL TABLE FOR CFA03

SYMBOL    REFERENCES
------    ------------------------------------------------------------------
          3520  3560  3660  3760  3780  3850  4140  4160  4230  4450
          4470  4670  4810  4830  4900  5000  5020  5060  5100  5360
Z5        0090  5270  5380  5430
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SECTION 6

PROGRAM CFA04 - SAMPLE SPECIFIC DATA GATHERER

CFA04 is the program which allows the user to enter sample-specific data into the reduced data file, CFA003. The program is entered by chaining from CFA03. It chains back to program CFA00 if the ESCAPE key is pressed.

As the program begins, it asks the user whether any of the samples have been diluted. If there are diluted samples, the program allows the user to enter dilution data for groups of samples. The groups are defined by the user in terms of their first and last wheel positions. The necessary data items for the diluted samples are the volume of the original sample and the volume of the dilution water. The program places these values into file CFA003 for all of the applicable unknowns.

Next, the program scans the file CFA003 to determine if there are any spiked samples in the batch. If there are, the program displays their wheel positions and demands additional data for each of them. The program asks the user whether the volume of the spiking solution is significant. It then allows the user to define a group of spiked samples to be handled simultaneously. If any of the unknowns associated with the spiked sample have not been diluted, the program asks for the original volume of the undiluted unknowns. If the volume of the spike is significant, the program asks the user for the volume of the spiking solution and the concentration of all of the analytes in the spike. If the volume of the spike is insignificant, the program asks the user for the mass of the spiking compounds. All of these items are added to CFA003 for all of the spiked samples in the group.

Finally, the program asks if the user wants any extra repeat positions to be added to the end of the batch. If extra repeat positions are requested, the program moves the last two trailing blanks and inserts the extra repeat positions at the end of CFA003.

The program then chains to CFA05.

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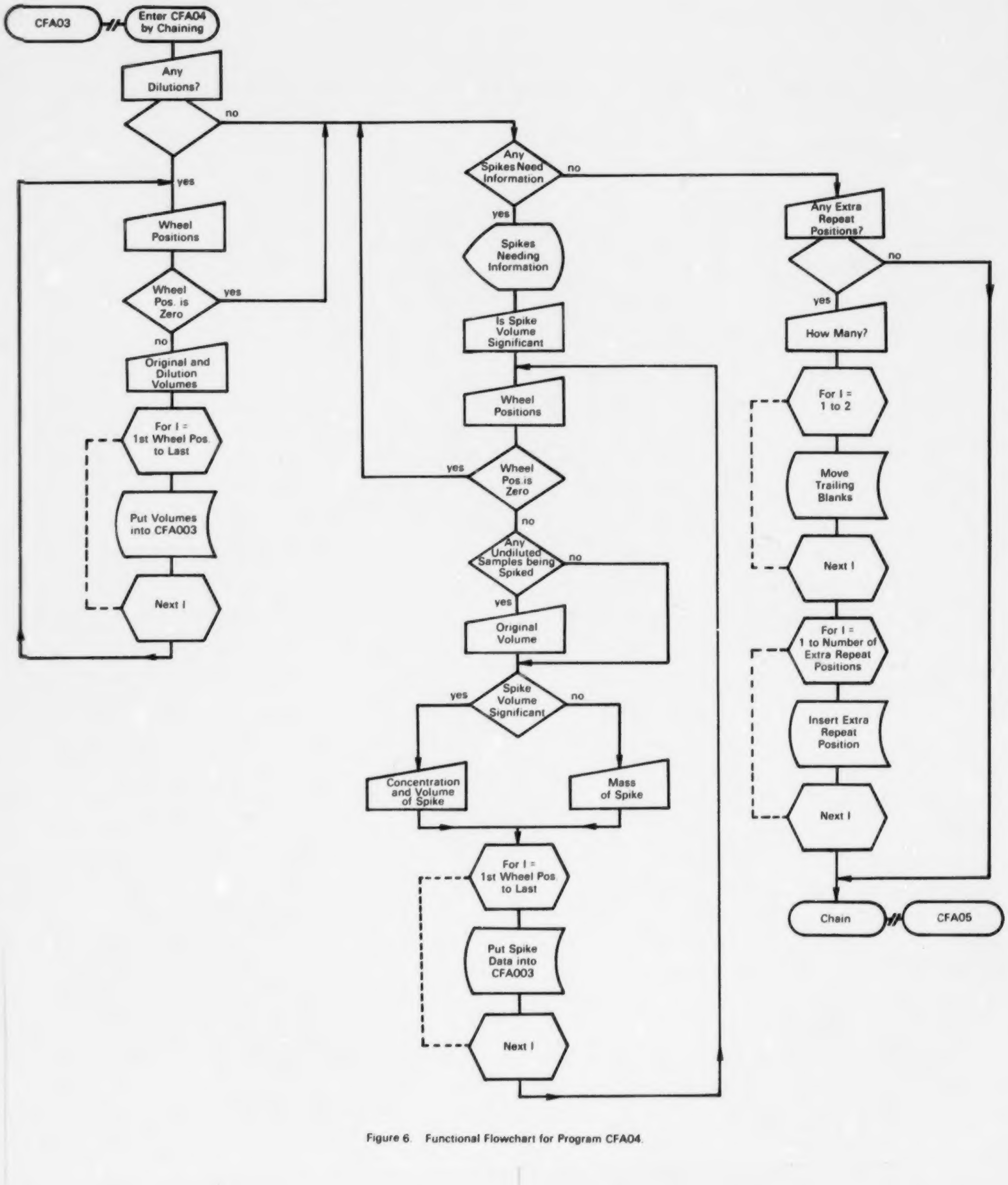
CFA03
Enter CFA04 by Chaining
Any Dilutions?
no
yes
Wheel Positions
Wheel Pos. is Zero
yes
no
Original and Dilution Volumes
For I = 1st Wheel Pos. to Last
Put Volumes into CFA003
Next I
Any Spikes Need Information
no
yes
Spikes Needing Information
Is Spike Volume Significant
Wheel Positions
yes
Wheel Pos.is Zero
no
Any Undiluted Samples being Spiked
no
yes
Original Volume
yes
Spike Volume Significant
no
Concentration and Volume of Spike
Mass of Spike
For I = 1st Wheel Pos. to Last
Put Spike Data into CFA003
Next I
Any Extra Repeat Positions?
no
yes
How Many?
For I = 1 to 2
Move Trailing Blanks
Next I
For I = 1 to Number of Extra Repeat Positions
Insert Extra Repeat Position
Next I
Chain
CFA05

Figure 6. Functional Flowchart for Program CFA04.

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TABLE 5. SYMBOL DEFINITIONS FOR CFA04

A$	the user's answer to several questions
A2$	the superstring of parameter-method codes
A3$	a general purpose string of formatted data
C()	the array of data common to all analytes for a wheel position; see symbol definitions for CFA03
F9	the first wheel position of an interval
I	the control variable for loops
J	the control variable for loops
L9	the last wheel position of an interval
N	the number of analytes
Q6	the wheel position of the associated unknown
R9$	the name of the run file
S$	the sample ID number
S()	the array of data specific to an analyte for a wheel position; see symbol definitions for CFA03
V0	the volume of the original sample
V1	the volume of the dilution water
V2()	the array of concentrations (or masses) for analytes in a spike
V3	the volume of the spiking solution
W	the total number of wheel positions for the batch
W2	the number of positions in one sample wheel
Z6	the number of spikes needing more information
Z8	the number of extra repeat positions

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C-O-N-T-I-N-U-O-U-S  F-L-O-W  A-N-A-L-Y-Z-E-R  A-U-T-O  S-Y-S-T-E-M
5/23/1980                                                     PAGE  1
                     PROGRAM LISTING FOR CFA04

123456789112345678921234567893123456789412345678951234567896123456789 7
         0         0         0         0         0         0         0
0010 REM   +=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+
0020 REM   +   CONTINUOUS FLOW ANALYZER AUTOMATION SYSTEM              +
0030 REM   +   PROGRAM CFA04, SAMPLE-SPECIFIC DATA GATHERER            +
0040 REM   +   BY:  J. KOPKE (UCCC)      JANUARY 24, 1980              +
0050 REM   +   MOST RECENT REVISION:  APRIL 15, 1980                   +
0060 REM   +=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+
0070 REM
0080 DIM A$[1],A2$[21],A3$[79],R9$[13],C[4],S$[8],S[14],V2[3]
0090 READ FILE[4,0],N,A2$,R9$,W
0100 ON ESC THEN GOTO 0130
0110 ESC
0120 GOTO 0190
0130 NOESC
0140 CLOSE
0150 ON ERR THEN GOTO 0170
0160 DELETE "CFA003"
0170 ON ERR THEN STOP
0180 CHAIN "CFA00"
0190 REM  ____________________________________________________________
0200 REM          INPUT DILUTION INFORMATION
0210 PRINT
0220 ON ERR THEN GOTO 0240
0230 INPUT "ANY DILUTIONS ([N],Y) >>  ",A$
0240 ON ERR THEN STOP
0250 IF A$="" THEN GOTO 0680
0260 IF A$="N" THEN GOTO 0680
0270 IF A$="Y" THEN GOTO 0310
0280 PRINT
0290 PRINT "<7>INVALID RESPONSE"
0300 GOTO 0210
0310 PRINT
0320 PRINT "SPECIFY WHEEL POSITIONS OF UNKNOWNS TO BE DILUTED;"
0330 PRINT "TYPE 0 (ZERO) AS A WHEEL POSITION TO END THE LIST"
0340 PRINT
0350 ON ERR THEN GOTO 0370
0360 INPUT "      FIRST POSITION >>  ",F9
0370 ON ERR THEN STOP
0380 IF F9=0 THEN GOTO 0680
0390 ON ERR THEN GOTO 0410
0400 INPUT "      LAST POSITION >>  ",L9
0410 ON ERR THEN STOP
0420 IF L9=0 THEN GOTO 0680

123456789112345678921234567893123456789412345678951234567896123456789 7
         0         0         0         0         0         0         0
```

```
C-O-N-T-I-N-U-O-U-S  F-L-O-W  A-N-A-L-Y-Z-E-R  A-U-T-O  S-Y-S-T-E-M
5/23/1980                                                     PAGE  2
                     PROGRAM LISTING FOR CFA04

123456789112345678921234567893123456789412345678951234567896123456789 7
         0         0         0         0         0         0         0
0430 IF F9<>INT(ABS(F9)) THEN GOTO 0480
0440 IF L9<>INT(ABS(L9)) THEN GOTO 0480
0450 IF L9<F9 THEN GOTO 0480
0460 IF L9>W THEN GOTO 0480
0470 GOTO 0510
0480 PRINT
0490 PRINT "<7>      INVALID RESPONSE"
0500 GOTO 0340
0510 ON ERR THEN GOTO 0530
0520 INPUT "      SAMPLE VOLUME IN ML >>  ",V0
0530 ON ERR THEN GOTO 0550
0540 INPUT "      DILUTION WATER VOLUME IN ML >>  ",V1
0550 ON ERR THEN STOP
0560 LET V0=V0/1000
0570 LET V1=V1/1000
0580 FOR I=F9 TO L9
0590   READ FILE[4,(I-1)*(N+1)+1],C[1],C[2],C[3],C[4],S$
0600   IF INT(C[1])<>3 THEN GOTO 0640
0610   LET C[2]=V0
0620   LET C[3]=V1
0630   WRITE FILE[4,(I-1)*(N+1)+1],C[1],C[2],C[3],C[4],S$
0640 NEXT I
0650 GOTO 0340
0660 REM  ____________________________________________________________
0670 REM          INPUT SPIKE INFORMATION
0680 LET Z6=0
0690 FOR I=7 TO W
0700   READ FILE[4,(I-1)*(N+1)+1],C[1],C[2],C[3],C[4],S$
0710   IF C[1]<>4 THEN GOTO 0910
0720   MAT READ FILE[4,(I-1)*(N+1)+2],S
0730   IF S[13]<>-99999 THEN GOTO 0910
0740   LET Z6=Z6+1
0750   IF Z6<>1 THEN GOTO 0830
0760   PRINT
0770   PRINT "LOCATION OF SPIKES WHICH REQUIRE ADDITIONAL DATA:"
0780   PRINT
0790   PRINT "WHEEL           WHEEL           WHEEL           WHEEL
*        WHEEL"
0800   PRINT " POS     ID      POS     ID      POS     ID      POS     ID
*         POS     ID"
0810   PRINT " ___ _______     ___ _______     ___ _______     ___ ______
*     _     ___ _______"

123456789112345678921234567893123456789412345678951234567896123456789 7
         0         0         0         0         0         0         0
```

EPA-287 (Cin.)
(4-76)

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```
C-O-N-T-I-N-U-O-U-S  F-L-O-W  A-N-A-L-Y-Z-E-R  A-U-T-O  S-Y-S-T-E-M
5/23/1980                                                     PAGE  3
                     PROGRAM LISTING FOR CFA04

12345678911234567892123456789312345678941234567895123456789612345678997
         0         0         0         0         0         0         0
0820   PRINT " ";
0830   LET A3$="000 ########"
0840   LET A3$[4-LEN(STR$(I)),3]=STR$(I)
0850   PRINT USING A3$,S$;
0860   IF Z6/5=INT(Z6/5) THEN GOTO 0890
0870   PRINT "   ";
0880   GOTO 0910
0890   PRINT
0900   PRINT " ";
0910 NEXT I
0920 IF Z6=0 THEN GOTO 1780
0930 PRINT
0940 PRINT
0950 ON ERR THEN GOTO 0970
0960 INPUT "IS VOLUME OF SPIKING SOLUTION SIGNIFICANT ([N],Y) >>  ",A$
0970 ON ERR THEN STOP
0980 IF A$="" THEN GOTO 1040
0990 IF A$="N" THEN GOTO 1040
1000 IF A$="Y" THEN GOTO 1040
1010 PRINT
1020 PRINT "<7>     INVALID RESPONSE"
1030 GOTO 0940
1040 PRINT
1050 PRINT "SPECIFY WHEEL POSITIONS OF SPIKES TO WHICH DATA APPLIES:"
1060 PRINT "TYPE 0 (ZERO) AS A WHEEL POSITION TO END THE LIST"
1070 PRINT
1080 ON ERR THEN GOTO 1100
1090 INPUT "     FIRST POSITION >>  ",F9
1100 ON ERR THEN STOP
1110 IF F9=0 THEN GOTO 0680
1120 ON ERR THEN GOTO 1140
1130 INPUT "     LAST POSITION >>  ",L9
1140 ON ERR THEN STOP
1150 IF L9=0 THEN GOTO 0680
1160 IF F9<>INT(ABS(F9)) THEN GOTO 1210
1170 IF L9<>INT(ABS(L9)) THEN GOTO 1210
1180 IF L9<F9 THEN GOTO 1210
1190 IF L9>N THEN GOTO 1210
1200 GOTO 1240
1210 PRINT
1220 PRINT "<7>     INVALID RESPONSE"
1230 GOTO 1070

12345678911234567892123456789312345678941234567895123456789612345678997
         0         0         0         0         0         0         0
```

```
C-O-N-T-I-N-U-O-U-S  F-L-O-W  A-N-A-L-Y-Z-E-R  A-U-T-O  S-Y-S-T-E-M
5/23/1980                                                     PAGE  4
                     PROGRAM LISTING FOR CFA04

12345678911234567892123456789312345678941234567895123456789612345678997
         0         0         0         0         0         0         0
1240 LET Z6=0
1250 FOR I=F9 TO L9
1260   READ FILE[4,(I-1)*(N+1)+1],C[1],C[2],C[3],C[4],S$
1270   IF C[1]<>4 THEN GOTO 1310
1280   LET Q6=C[4]
1290   READ FILE[4,(Q6-1)*(N+1)+1],C[1],C[2],C[3],C[4],S$
1300   IF C[3]=0 THEN LET Z6=Z6+1
1310 NEXT I
1320 IF Z6=0 THEN GOTO 1370
1330 ON ERR THEN GOTO 1350
1340 INPUT "     SAMPLE VOLUME IN ML >>  ",V0
1350 ON ERR THEN STOP
1360 LET V0=V0/1000
1370 IF A$<>"Y" THEN GOTO 1500
1380 PRINT "     CONCENTRATION OF SPIKING SOLUTION IN DEFAULT UNITS:"
1390 FOR I=1 TO N
1400   PRINT "            ";A2$[I*7-6,I*7];
1410   ON ERR THEN GOTO 1430
1420   INPUT " >>  ",V2[I]
1430   ON ERR THEN STOP
1440 NEXT I
1450 ON ERR THEN GOTO 1470
1460 INPUT "     VOLUME OF SPIKING SOLUTION IN ML >>  ",V3
1470 ON ERR THEN STOP
1480 LET V3=V3/1000
1490 GOTO 1580
1500 PRINT "     MASS OF SPIKING COMPOUND IN DEFAULT MASS UNITS:"
1510 FOR I=1 TO N
1520   PRINT "            ";A2$[I*7-6,I*7];
1530   ON ERR THEN GOTO 1550
1540   INPUT " >>  ",V2[I]
1550   ON ERR THEN STOP
1560 NEXT I
1570 LET V3=0
1580 FOR I=F9 TO L9
1590   READ FILE[4,(I-1)*(N+1)+1],C[1],C[2],C[3],C[4],S$
1600   IF C[1]<>4 THEN GOTO 1740
1610   MAT READ FILE[4,(I-1)*(N+1)+2],S
1620   IF S[13]<>-99999 THEN GOTO 1740
1630   LET C[2]=V3
1640   WRITE FILE[4,(I-1)*(N+1)+1],C[1],C[2],C[3],C[4],S$
1650   FOR J=1 TO N

12345678911234567892123456789312345678941234567895123456789612345678997
         0         0         0         0         0         0         0
```

PAGE NUMBER
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(4-76)

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```
C-O-N-T-I-N-U-O-U-S   F-L-O-W   A-N-A-L-Y-Z-E-R   A-U-T-O   S-Y-S-T-E-M
5/23/1980                                                           PAGE  5
                       PROGRAM LISTING FOR CFA04

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
1660      MAT READ FILE[4,(I-1)*(N+1)+J+1],S
1670      LET S[13]=V2[J]
1680      MAT WRITE FILE[4,(I-1)*(N+1)+J+1],S
1690    NEXT J
1700    LET Q6=C[4]
1710    READ FILE[4,(Q6-1)*(N+1)+1],C[1],C[2],C[3],C[4],S$
1720    IF C[3]=0 THEN LET C[2]=V0
1730    WRITE FILE[4,(Q6-1)*(N+1)+1],C[1],C[2],C[3],C[4],S$
1740 NEXT I
1750 GOTO 1070
1760 REM  ______________________________________________________________
1770 REM           INSERT REMEASUREMENT POSITIONS
1780 PRINT
1790 ON ERR THEN GOTO 1810
1800 INPUT "WANT ANY EXTRA REPEAT POSITIONS ([N],Y) >>  ",A$
1810 ON ERR THEN STOP
1820 IF A$="" THEN GOTO 2180
1830 IF A$="N" THEN GOTO 2180
1840 IF A$="Y" THEN GOTO 1880
1850 PRINT
1860 PRINT "<7>INVALID RESPONSE"
1870 GOTO 1780
1880 PRINT
1890 ON ERR THEN GOTO 1910
1900 INPUT "HOW MANY EXTRA REPEAT POSITIONS >>  ",Z8
1910 ON ERR THEN STOP
1920 IF Z8=INT(Z8) THEN IF Z8>0 THEN GOTO 1960
1930 PRINT
1940 PRINT "<7>INVALID RESPONSE"
1950 GOTO 1780
1960 FOR I=W-1 TO W
1970    READ FILE[4,(I-1)*(N+1)+1],C[1],C[2],C[3],C[4],S$
1980    WRITE FILE[4,(I+Z8-1)*(N+1)+1],C[1],C[2],C[3],C[4],S$
1990    FOR J=1 TO N
2000      MAT READ FILE[4,(I-1)*(N+1)+J+1],S
2010      MAT WRITE FILE[4,(I+Z8-1)*(N+1)+J+1],S
2020    NEXT J
2030 NEXT I
2040 LET C[1]=10
2050 LET C[2]=1
2060 LET C[3]=0
2070 LET C[4]=0

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
```

```
C-O-N-T-I-N-U-O-U-S   F-L-O-W   A-N-A-L-Y-Z-E-R   A-U-T-O   S-Y-S-T-E-M
5/23/1980                                                           PAGE  6
                       PROGRAM LISTING FOR CFA04

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
2080 LET S$="        "
2090 MAT S=ZER
2100 LET S[1]=-99999
2110 FOR I=W-1 TO W+Z8-2
2120    WRITE FILE[4,(I-1)*(N+1)+1],C[1],C[2],C[3],C[4],S$
2130    FOR J=1 TO N
2140      MAT WRITE FILE[4,(I-1)*(N+1)+J+1],S
2150    NEXT J
2160 NEXT I
2170 LET W=W+Z8
2180 PRINT
2190 ON ERR THEN GOTO 2210
2200 INPUT "NUMBER OF POSITIONS IN ONE SAMPLE WHEEL >>  ",W2
2210 ON ERR THEN STOP
2220 IF W2=INT(W2) THEN IF W2>0 THEN GOTO 2260
2230 PRINT
2240 PRINT "<7>INVALID RESPONSE"
2250 GOTO 2180
2260 WRITE FILE[4,0],N,A2$,R9$,W,W2,0
2270 NOESC
2280 CHAIN "CFA05"

1234567891123456789212345678931234567894123456789512345678961234567897
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```

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M OF AREA; DE SION BLES AND ILLUSTRATIONS

```
C-O-N-T-I-N-U-O-U-S   F-L-O-W   A-N-A-L-Y-Z-E-R   A-U-T-O   S-Y-S-T-E-M
5/23/1980                                                          PAGE  7
                      SYMBOL TABLE FOR CFA04

SYMBOL   REFERENCES
------   ----------------------------------------------------------------

 0130    0100
 0170    0150
 0190    0120
 0210    0300
 0240    0220
 0310    0270
 0340    0500  0650
 0370    0350
 0410    0390
 0480    0430  0440  0450  0460
 0510    0470
 0530    0510
 0550    0530
 0640    0600
 0680    0250  0260  0380  0420  1110  1150
 0830    0750
 0890    0860
 0910    0710  0730  0880
 0940    1030
 0970    0950
 1040    0980  0990  1000
 1070    1230  1750
 1100    1080
 1140    1120
 1210    1160  1170  1180  1190
 1240    1200
 1310    1270
 1350    1330
 1370    1320
 1430    1410
 1470    1450
 1500    1370
 1550    1530
 1580    1490
 1740    1600  1620
 1780    0920  1870  1950
 1810    1790
 1880    1840
 1910    1890
 1960    1920
 2180    1820  1830  2250
 2210    2190
 2260    2220
 A$      0080  0230  0250  0260  0270  0960  0980  0990  1000  1370
         1800  1820  1830  1840
```

```
C-O-N-T-I-N-U-O-U-S   F-L-O-W   A-N-A-L-Y-Z-E-R   A-U-T-O   S-Y-S-T-E-M
5/23/1980                                                          PAGE  8
                      SYMBOL TABLE FOR CFA04

SYMBOL   REFERENCES
------   ----------------------------------------------------------------

 A2$     0080  0090  1400  1520  2260
 A3$     0080  0830  0840  0850
 C[      0080  0590  0600  0610  0620  0630  0700  0710  1260  1270
         1280  1290  1300  1590  1600  1630  1640  1700  1710  1720
         1730  1970  1980  2040  2050  2060  2070  2120
 F9      0360  0380  0430  0450  0580  1090  1110  1160  1180  1250
         1580
 FL#4    0090  0590  0630  0700  0720  1260  1290  1590  1610  1640
         1660  1680  1710  1730  1970  1980  2000  2010  2120  2140
         2260
 I       0580  0590  0630  0640  0690  0700  0720  0840  0910  1250
         1260  1310  1390  1400  1420  1440  1510  1520  1540  1560
         1580  1590  1610  1640  1660  1680  1740  1960  1970  1980
         2000  2010  2030  2110  2120  2140  2160
 J       1650  1660  1670  1680  1690  1990  2000  2010  2020  2130
         2140  2150
 L9      0400  0420  0440  0450  0460  0580  1130  1150  1170  1180
         1190  1250  1580
 N       0090  0590  0630  0700  0720  1260  1290  1390  1510  1590
         1610  1640  1650  1660  1680  1710  1730  1970  1980  1990
         2000  2010  2120  2130  2140  2260
 Q6      1280  1290  1700  1710  1730
 R9$     0080  0090  2260
 S       0720  1610  1660  1680  2000  2010  2090  2140
 S$      0080  0590  0630  0700  0850  1260  1290  1590  1640  1710
         1730  1970  1980  2080  2120
 S[      0080  0730  1620  1670  2100
 V0      0520  0560  0610  1340  1360  1720
 V1      0540  0570  0620
 V2[     0080  1420  1540  1670
 V3      1460  1480  1570  1630
 W       0090  0460  0690  1190  1960  2110  2170  2260
 W2      2200  2220  2260
 Z6      0680  0740  0750  0860  0920  1240  1300  1320
 Z8      1900  1920  1980  2010  2110  2170
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SECTION 7

PROGRAM CFA05 - SAMPLE WHEEL PATTERN PRINTER

CFA05 is the program which prints the sample wheel pattern on the terminal, the lineprinter, or both. It is entered by chaining from CFA04. It chains back to CFA00 if the ESCAPE key is pressed.

As CFA05 begins, it asks the user whether it should print the sample wheel pattern on the lineprinter, the terminal, both, or neither. If the user wants neither, the program chains directly to CFA06.

If the user wants any printout, the program assembles the report in file CFA000, the temporary output file. CFA05 first puts the headings into CFA000, and it then reads the data from file CFA003, formats it, and prints it into file CFA000.

For a terminal printout, the program simply copies the contents of CFA000 to the terminal. For a lineprinter printout, the program first opens the lineprinter. If that device is in use, the program informs the user of the problem, delays ten seconds, and tries again. When the lineprinter is open, the program copies the report from CFA000 to the lineprinter, advancing to the top of the next page after every 63 lines.

When the report has been printed, the program chains to CFA06.

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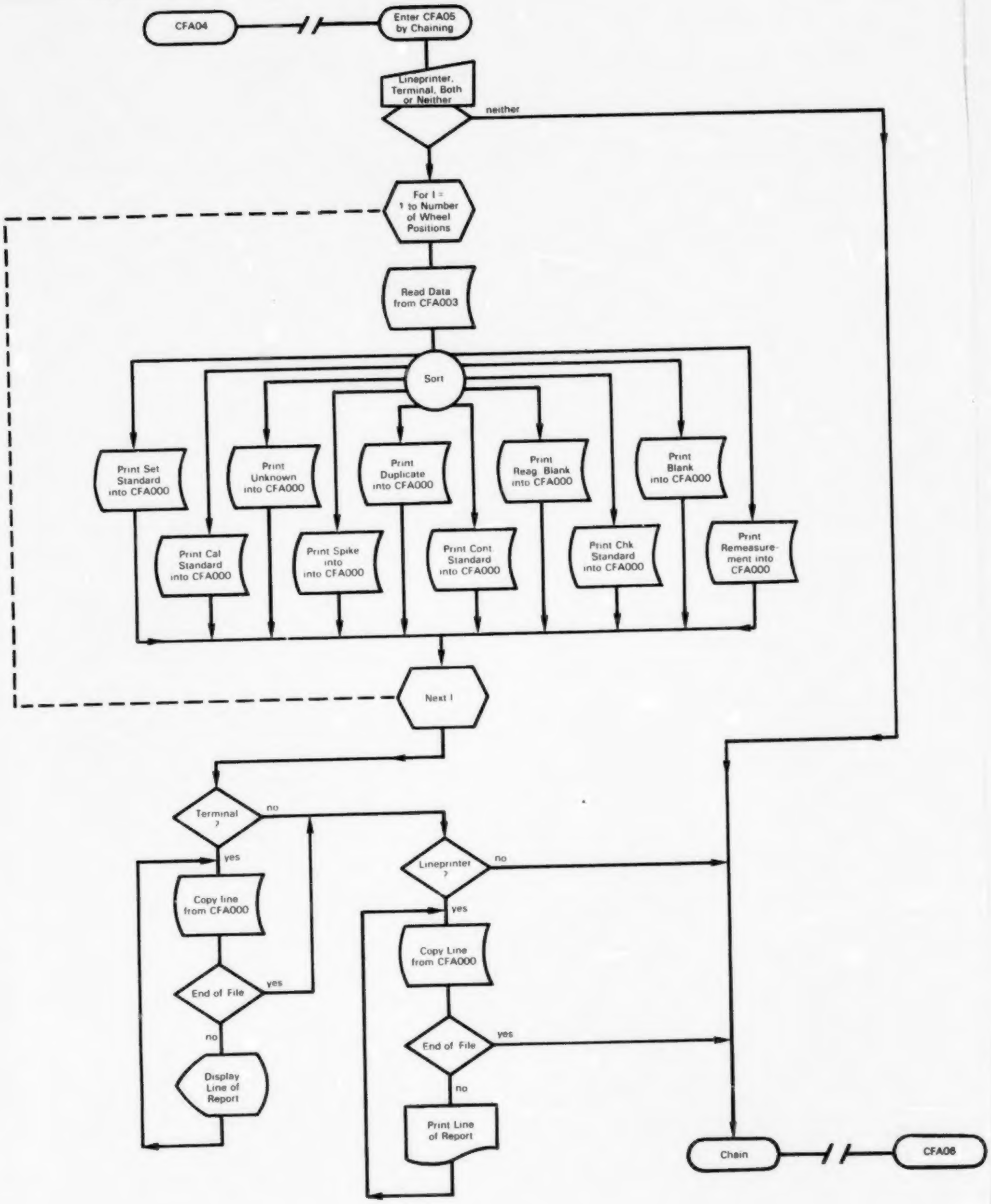
CFA04
Enter CFA05 by Chaining
Lineprinter, Terminal, Both or Neither
neither
For I = 1 to Number of Wheel Positions
Read Data from CFA003
Sort
Print Set Standard into CFA000
Print Unknown into CFA000
Print Duplicate into CFA000
Print Reag. Blank into CFA000
Print Blank into CFA000
Print Cal Standard into CFA000
Print Spike into into CFA000
Print Cont. Standard into CFA000
Print Chk Standard into CFA000
Print Remeasurement into CFA000
Next I
Terminal ?
no
yes
Copy line from CFA000
End of File
yes
no
Display Line of Report
Lineprinter ?
no
yes
Copy Line from CFA000
End of File
yes
no
Print Line of Report
Chain
CFA06

Figure 7. Functional Flowchart for Program CFA05

BOTTOM OF IMAGE AREA; OUTSIDE DIMENSION FOR TABLES AND ILLUSTRATIONS
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(4-76)

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TABLE 6. SYMBOL DEFINITIONS FOR CFA05

A$	the user's answer to several questions
A2$	the superstring of parameter-method codes
A3$	a multi-purpose string of formatted data
C1()	the array of theoretical concentrations of calibration standards, concentrations or masses of spikes, or concentrations of control standards
C()	the array of data common to all analytes for a wheel position; see symbol definitions for CFA03
I	the control variable for loops
J	the control variable for loops
N	the number of analytes
Q5	the volume of the spiking solution
Q6	the wheel position of the associated unknown sample
R9$	the name of the run file
S$	the sample ID
S()	the array of data specific to one analyte for a wheel position; see symbol definitions for CFA03
W	the total number of wheel positions for the batch
W2	the number of positions in the sample wheel
X8	a counter for the number of lines printed on one page of a lineprinter report

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EPA-287 (Cin.)
(4-76)

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```
C-O-N-T-I-N-U-O-U-S  F-L-O-W  A-N-A-L-Y-Z-E-R  A-U-T-O  S-Y-S-T-E-M
5/23/1980                                                     PAGE  1
                    PROGRAM LISTING FOR CFA05

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
0010 REM   +=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+
0020 REM   +   CONTINUOUS FLOW ANALYZER AUTOMATION SYSTEM               +
0030 REM   +   PROGRAM CFA05, SAMPLE WHEEL PATTERN PRINTER             +
0040 REM   +   BY:  J. KOPKE (UCCC)      JANUARY 29, 1980              +
0050 REM   +   MOST RECENT REVISION:  APRIL 15, 1980                   +
0060 REM   +=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+
0070 REM
0080 DIM A$[1],A2$[21],A3$[79],C1[3],C[4],R9$[13],S$[8],S[14]
0090 ON ESC THEN GOTO 0120
0100 ESC
0110 GOTO 0210
0120 NOESC
0130 CLOSE
0140 CHAIN "CFA00"
0150 PRINT
0160 PRINT "H = HELP"
0170 PRINT "L = LINEPRINTER"
0180 PRINT "T = TERMINAL"
0190 PRINT "B = BOTH LINEPRINTER AND TERMINAL"
0200 PRINT "N = NEITHER LINEPRINTER NOR TERMINAL"
0210 PRINT
0220 ON ERR THEN GOTO 0240
0230 INPUT "FORM OF SAMPLE WHEEL PATTERN REPORT ([H],L,T,B,N) >>  ",A$
0240 ON ERR THEN STOP
0250 IF A$="" THEN GOTO 0150
0260 IF A$="H" THEN GOTO 0150
0270 IF A$="L" THEN GOTO 0360
0280 IF A$="T" THEN GOTO 0360
0290 IF A$="B" THEN GOTO 0360
0300 IF A$="N" THEN GOTO 2170
0310 PRINT
0320 PRINT "<7>INVALID RESPONSE"
0330 GOTO 0150
0340 REM   ------------------------------------------------------------
0350 REM           ASSEMBLE TEMPORARY OUTPUT FILE
0360 OPEN FILE[0,1],"CFA000"
0370 READ FILE[4,0],N,A2$,R9$,W,W2
0380 PRINT
0390 PRINT "THE REPORT IS BEING PREPARED...";
0400 PRINT FILE[0],"                       S-A-M-P-L-E   W-H-E-E-L   P-A-T-T
*    -E-R-N"
0410 LET A3$="                                      DATE:  00/00/00"

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
```

```
C-O-N-T-I-N-U-O-U-S  F-L-O-W  A-N-A-L-Y-Z-E-R  A-U-T-O  S-Y-S-T-E-M
5/23/1980                                                     PAGE  2
                    PROGRAM LISTING FOR CFA05

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
0420 LET A3$[40-LEN(STR$(SYS(2))),39]=STR$(SYS(2))
0430 LET A3$[43-LEN(STR$(SYS(1))),42]=STR$(SYS(1))
0440 LET A3$[46-LEN(STR$(SYS(3)-1900)),45]=STR$(SYS(3)-1900)
0450 PRINT FILE[0],A3$
0460 PRINT FILE[0]
0470 LET A3$="   WHEEL          SAMPLE    DILUTION      "
0480 FOR I=1 TO N
0490   LET A3$=A3$,"     ",A2$[I*7-6,I*7]
0500 NEXT I
0510 PRINT FILE[0],A3$
0520 LET A3$=" POSITION         TYPE      FACTOR        "
0530 FOR I=1 TO N
0540   LET A3$=A3$,"    RESULTS"
0550 NEXT I
0560 PRINT FILE[0],A3$
0570 LET A3$="-----------  -----------  -------         "
0580 FOR I=1 TO N
0590   LET A3$=A3$,"   ---------"
0600 NEXT I
0610 PRINT FILE[0],A3$
0620 FOR I=1 TO W
0630   LET A3$="000 (0/000)   "
0640   LET A3$[4-LEN(STR$(I)),3]=STR$(I)
0650   LET A3$[6,6]=STR$(INT((I-1)/W2)+1)
0660   LET A3$[11-LEN(STR$(I-INT((I-1)/W2)*W2)),10]=STR$(I-INT((I-1)/W
*    2)*W2)
0670   READ FILE[4,(I-1)*(N+1)+1],C[1],C[2],C[3],C[4],S$
0680   ON C[1] THEN GOTO 0710, 0760, 0930, 0980, 1240, 1320, 1490, 154
*    0, 1600, 1640
0690   REM   -----------------------------------
0700   REM             TIMING SET STANDARD
0710   LET A3$=A3$,"SET STANDARD"
0720   PRINT FILE[0],A3$
0730   GOTO 1670
0740   REM   -----------------------------------
0750   REM             CALIBRATION STANDARD
0760   LET A3$=A3$,"CAL STANDARD            TCONC:"
0770   FOR J=1 TO N
0780     LET A3$=A3$,"------#.### "
0790   NEXT J
0800   FOR J=1 TO N
0810     MAT READ FILE[4,(I-1)*(N+1)+J+1],S

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
```

PAGE NUMBER
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(4-76)
AND ILLUSTRATIONS

```
C-O-N-T-I-N-U-O-U-S   F-L-O-W   A-N-A-L-Y-Z-E-R   A-U-T-O   S-Y-S-T-E-M
5/23/1980                                                     PAGE  3
                     PROGRAM LISTING FOR CFA05

 1234567891123456789212345678931234567894123456789512345678961234567897
          0         0         0         0         0         0         0
0820      LET C1[J]=S[13]
0830    NEXT J
0840    ON N THEN GOTO 0850, 0870, 0890
0850    PRINT FILE[0],USING A3$,C1[1]
0860    GOTO 1670
0870    PRINT FILE[0],USING A3$,C1[1],C1[2]
0880    GOTO 1670
0890    PRINT FILE[0],USING A3$,C1[1],C1[2],C1[3]
0900    GOTO 1670
0910    REM   ----------------------------------
0920    REM          UNKNOWN
0930    LET A3$=A3$,"ID: ########  ####.##"
0940    PRINT FILE[0],USING A3$,S$,(C[2]+C[3])/C[2]
0950    GOTO 1670
0960    REM   ----------------------------------
0970    REM          SPIKE
0980    LET A3$=A3$,"SPIKE OF 000"
0990    LET A3$[26-LEN(STR$(C[4])),25]=STR$(C[4])
1000    LET A3$=A3$,"  ####.##"
1010    LET Q5=C[2]
1020    LET Q6=C[4]
1030    READ FILE[4,(Q6-1)*(N+1)+1],C[1],C[2],C[3],C[4],S$
1040     IF Q5=0 THEN GOTO 1070
1050    PRINT FILE[0],USING A3$,(C[2]+C[3])/C[2]
1060    GOTO 1670
1070    LET A3$=A3$,"   LSA:"
1080    FOR J=1 TO N
1090      LET A3$=A3$,"-----#.### "
1100    NEXT J
1110    FOR J=1 TO N
1120      MAT READ FILE[4,(I-1)*(N+1)+J+1],S
1130      LET.C1[J]=S[13]
1140    NEXT J
1150    ON N THEN GOTO 1160, 1180, 1200
1160    PRINT FILE[0],USING A3$,(C[2]+C[3])/C[2],C1[1]/C[2]
1170    GOTO 1670
1180    PRINT FILE[0],USING A3$,(C[2]+C[3])/C[2],C1[1]/C[2],C1[2]/C[2]
1190    GOTO 1670
1200    PRINT FILE[0],USING A3$,(C[2]+C[3])/C[2],C1[1]/C[2],C1[2]/C[2],
*     C1[3]/C[2]
1210    GOTO 1670
1220    REM   ----------------------------------

 1234567891123456789212345678931234567894123456789512345678961234567897
          0         0         0         0         0         0         0
```

```
C-O-N-T-I-N-U-O-U-S   F-L-O-W   A-N-A-L-Y-Z-E-R   A-U-T-O   S-Y-S-T-E-M
5/23/1980                                                     PAGE  4
                     PROGRAM LISTING FOR CFA05

 1234567891123456789212345678931234567894123456789512345678961234567897
          0         0         0         0         0         0         0
1230    REM          DUPLICATE
1240    LET A3$=A3$,"DUPE  OF 000  ####.##"
1250    LET A3$[26-LEN(STR$(C[4])),25]=STR$(C[4])
1260    LET Q6=C[4]
1270    READ FILE[4,(Q6-1)*(N+1)+1],C[1],C[2],C[3],C[4],S$
1280    PRINT FILE[0],USING A3$,(C[2]+C[3])/C[2]
1290    GOTO 1670
1300    REM   ----------------------------------
1310    REM          CONTROL STANDARD
1320    LET A3$=A3$,"CONTROL STND            LCT:"
1330    FOR J=1 TO N
1340      LET A3$=A3$,"-----#.### "
1350    NEXT J
1360    FOR J=1 TO N
1370      MAT READ FILE[4,(I-1)*(N+1)+J+1],S
1380      LET C1[J]=S[13]
1390    NEXT J
1400    ON N THEN GOTO 1410, 1430, 1450
1410    PRINT FILE[0],USING A3$,C1[1]
1420    GOTO 1670
1430    PRINT FILE[0],USING A3$,C1[1],C1[2]
1440    GOTO 1670
1450    PRINT FILE[0],USING A3$,C1[1],C1[2],C1[3]
1460    GOTO 1670
1470    REM   ----------------------------------
1480    REM          REAGENT BLANK
1490    LET A3$=A3$,"REAGENT BLNK"
1500    PRINT FILE[0],A3$
1510    GOTO 1670
1520    REM   ----------------------------------
1530    REM          CHECK STANDARD
1540    LET A3$=A3$,"CHECK OF 000"
1550    LET A3$[26-LEN(STR$(C[4])),25]=STR$(C[4])
1560    PRINT FILE[0],A3$
1570    GOTO 1670
1580    REM   ----------------------------------
1590    REM          BLANK
1600    LET A3$=A3$,"BLANK"
1610    PRINT FILE[0],A3$
1620    GOTO 1670
1630    REM   ----------------------------------
1640    REM          REMEASUREMENT POSITION

 1234567891123456789212345678931234567894123456789512345678961234567897
          0         0         0         0         0         0         0
```

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(4-76)

```
C-O-N-T-I-N-U-O-U-S   F-L-O-W   A-N-A-L-Y-Z-E-R   A-U-T-O   S-Y-S-T-E-M
5/23/1980                                                          PAGE  5
                       PROGRAM LISTING FOR CFA05

 1234567891123456789212345678931234567894123456789512345678961234567897
          0         0         0         0         0         0         0
 1650    LET A3$=A3$,"REPEAT OF [ ] ####.##"
 1660    PRINT FILE[0],USING A3$,(C[2]+C[3])/C[2]
 1670     IF I/10=INT(I/10) THEN PRINT ".";
 1680 NEXT I
 1690 PRINT
 1700 CLOSE FILE[0]
 1710 REM     ---------------------------------------------------------
 1720 REM               TERMINAL COPY
 1730 IF A$="T" THEN GOTO 1760
 1740 IF A$="B" THEN GOTO 1760
 1750 GOTO 1900
 1760 FOR I=1 TO 5
 1770    PRINT
 1780 NEXT I
 1790 OPEN FILE[0,3],"CFA000"
 1800 LREAD FILE[0],A3$
 1810 IF EOF(0) THEN GOTO 1840
 1820 PRINT A3$
 1830 GOTO 1800
 1840 CLOSE FILE[0]
 1850 FOR I=1 TO 5
 1860    PRINT
 1870 NEXT I
 1880 REM     ---------------------------------------------------------
 1890 REM               LINEPRINTER COPY
 1900 IF A$="L" THEN GOTO 1930
 1910 IF A$="B" THEN GOTO 1930
 1920 GOTO 2170
 1930 PRINT
 1940 PRINT "THE REPORT IS BEING SENT TO THE LINEPRINTER...";
 1950 ON ERR THEN GOTO 1990
 1960 OPEN FILE[7,1],"$LPT"
 1970 ON ERR THEN STOP
 1980 GOTO 2040
 1990 ON ERR THEN STOP
 2000 PRINT
 2010 PRINT "THE LINEPRINTER IS IN USE.  THERE WILL BE A 10-SECOND DELA
*      Y"
 2020 DELAY =10
 2030 GOTO 1950
 2040 OPEN FILE[0,3],"CFA000"
 2050 LET X8=0

 1234567891123456789212345678931234567894123456789512345678961234567897
          0         0         0         0         0         0         0
```

```
C-O-N-T-I-N-U-O-U-S   F-L-O-W   A-N-A-L-Y-Z-E-R   A-U-T-O   S-Y-S-T-E-M
5/23/1980                                                          PAGE  6
                       PROGRAM LISTING FOR CFA05

 1234567891123456789212345678931234567894123456789512345678961234567897
          0         0         0         0         0         0         0
 2060 LREAD FILE[0],A3$
 2070 IF EOF(0) THEN GOTO 2140
 2080 PRINT FILE[7],A3$
 2090 LET X8=X8+1
 2100 IF X8<>63 THEN GOTO 2060
 2110 PRINT FILE[7],"<12>"
 2120 PRINT ".";
 2130 GOTO 2060
 2140 CLOSE FILE[0]
 2150 CLOSE FILE[7]
 2160 PRINT
 2170 NOESC
 2180 CHAIN "CFA06"

 1234567891123456789212345678931234567894123456789512345678961234567897
          0         0         0         0         0         0         0
```

TYPING GUIDE SHEET
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EPA-337 (Cin.)
(6-75)

TYPING GUIDE SHEET
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```
C-O-N-T-I-N-U-O-U-S  F-L-O-W  A-N-A-L-Y-Z-E-R  A-U-T-O  S-Y-S-T-E-M
5/23/1980                                                    PAGE  7
                     SYMBOL TABLE FOR CFA05

SYMBOL   REFERENCES
------   -----------------------------------------------------------
 0120  0090
 0150  0250  0260  0330
 0210  0110
 0240  0220
 0360  0270  0280  0290
 0710  0680
 0760  0680
 0850  0840
 0870  0840
 0890  0840
 0930  0680
 0980  0680
 1070  1040
 1160  1150
 1180  1150
 1200  1150
 1240  0680
 1320  0680
 1410  1400
 1430  1400
 1450  1400
 1490  0680
 1540  0680
 1600  0680
 1640  0680
 1670  0730  0860  0880  0900  0950  1060  1170  1190  1210  1290
       1420  1440  1460  1510  1570  1620
 1760  1730  1740
 1800  1830
 1840  1810
 1900  1750
 1930  1900  1910
 1950  2030
 1990  1950
 2040  1980
 2060  2100  2130
 2140  2070
 2170  0300  1920
 A$    0080  0230  0250  0260  0270  0280  0290  0300  1730  1740
       1900  1910
 A2$   0080  0370  0490
 A3$   0080  0410  0420  0430  0440  0450  0470  0490  0510  0520
       0540  0560  0570  0590  0610  0630  0640  0650  0660  0710
       0720  0760  0780  0850  0870  0890  0930  0940  0980  0990
       1000  1050  1070  1090  1160  1180  1200  1240  1250  1280
```

```
C-O-N-T-I-N-U-O-U-S  F-L-O-W  A-N-A-L-Y-Z-E-R  A-U-T-O  S-Y-S-T-E-M
5/23/1980                                                    PAGE  8
                     SYMBOL TABLE FOR CFA05

SYMBOL   REFERENCES
------   -----------------------------------------------------------
       1320  1340  1410  1430  1450  1490  1500  1540  1550  1560
       1600  1610  1650  1660  1800  1820  2060  2080
 C1[   0080  0820  0850  0870  0890  1130  1160  1180  1200  1380
       1410  1430  1450
 C[    0080  0670  0680  0940  0990  1010  1020  1030  1050  1160
       1180  1200  1250  1260  1270  1280  1550  1660
 FL#0  0360  0400  0450  0460  0510  0560  0610  0720  0850  0870
       0890  0940  1050  1160  1180  1200  1280  1410  1430  1450
       1500  1560  1610  1660  1700  1790  1800  1840  2040  2060
       2140
 FL#4  0370  0670  0810  1030  1120  1270  1370
 FL#7  1960  2080  2110  2150
 I     0480  0490  0500  0530  0550  0580  0600  0620  0640  0650
       0660  0670  0810  1120  1370  1670  1680  1760  1780  1850
       1870
 J     0770  0790  0800  0810  0820  0830  1080  1100  1110  1120
       1130  1140  1330  1350  1360  1370  1380  1390
 N     0370  0480  0530  0580  0670  0770  0800  0810  0840  1030
       1080  1110  1120  1150  1270  1330  1360  1370  1400
 Q5    1010  1040
 Q6    1020  1030  1260  1270
 R9$   0080  0370
 S     0810  1120  1370
 S$    0080  0670  0940  1030  1270
 S[    0080  0820  1130  1380
 W     0370  0620
 W2    0370  0650  0660
 X8    2050  2090  2100
```

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(4-73)

SECTION 8

PROGRAM CFA06 - AUTOMATION PARAMETER GATHERER

CFA06 is the program which allows the user to input eleven various automation parameters. It is entered by chaining from program CFA06, and it chains back to CFA00 if the ESCAPE key is pressed.

The automation parameters are stored in file CFA004. The first time that this program is executed in a directory, it forces the user to generate a CFA004 file. On subsequent executions of the program, it allows the user to accept all of the automation parameters currently in the file as a unit, or to accept some of them and replace others individually. If the escape key is pressed, the CFA004 file is deleted.

As the program begins, it first checks whether the CFA004 file exists. If it does not, the program forces the user to generate one. If the CFA004 file does exist, the program checks whether the superstring of parameter-method codes in it matches that of the current CFA003 file. If the superstrings do not match, the CFA004 file is deleted, and the user is forced to generate a new one. Throughout the rest of the program, the flag X9 indicates the mode in which the program is being used. If X9 equals 0, the user is generating a new CFA004; if X9 equals 1, the user is updating and old CFA004.

The program first asks the user for the default unit of concentration for each analyte. The program then asks the user for the time between peaks. If the user is generating a new CFA004, the time between peaks must be typed in. If the user is updating an old CFA004, the last value entered for the time between peaks is presented as a default value. If the user types a carriage return alone, the program leaves the value for the time between peaks unaltered in CFA004. If the user types a different value, it replaces the old value in the file. This default feature is implemented for most of the questions in the program, but will not be described again for each of them.

The program then asks if a subtracted results report should be prepared from the results of the batch. If the user wants such a report, the parameter-method codes for the minuend and subtrahend compounds must also be entered.

Next, the user must specifiy whether the additional dilution factor for an offscale sample should be fixed or variable, and if it is fixed, the factor itself must be entered.

There are then eight questions where the answers may be different for each analyte. These questions involve the analogue to digital converter channel numbers, the threshold heights for the timing set standards, the data acquisition window widths, the standard deviations defining levelness, the degrees of least squares fit, the detection limits, the offscale sample concentrations, and the allowable errors for instrument check standards. The input of all of these values is accomplished by the subroutine at the end of the program.

When CFA06 ends, it closes all of the files and chains to CFA07.

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TOP OF IMAGE AREA
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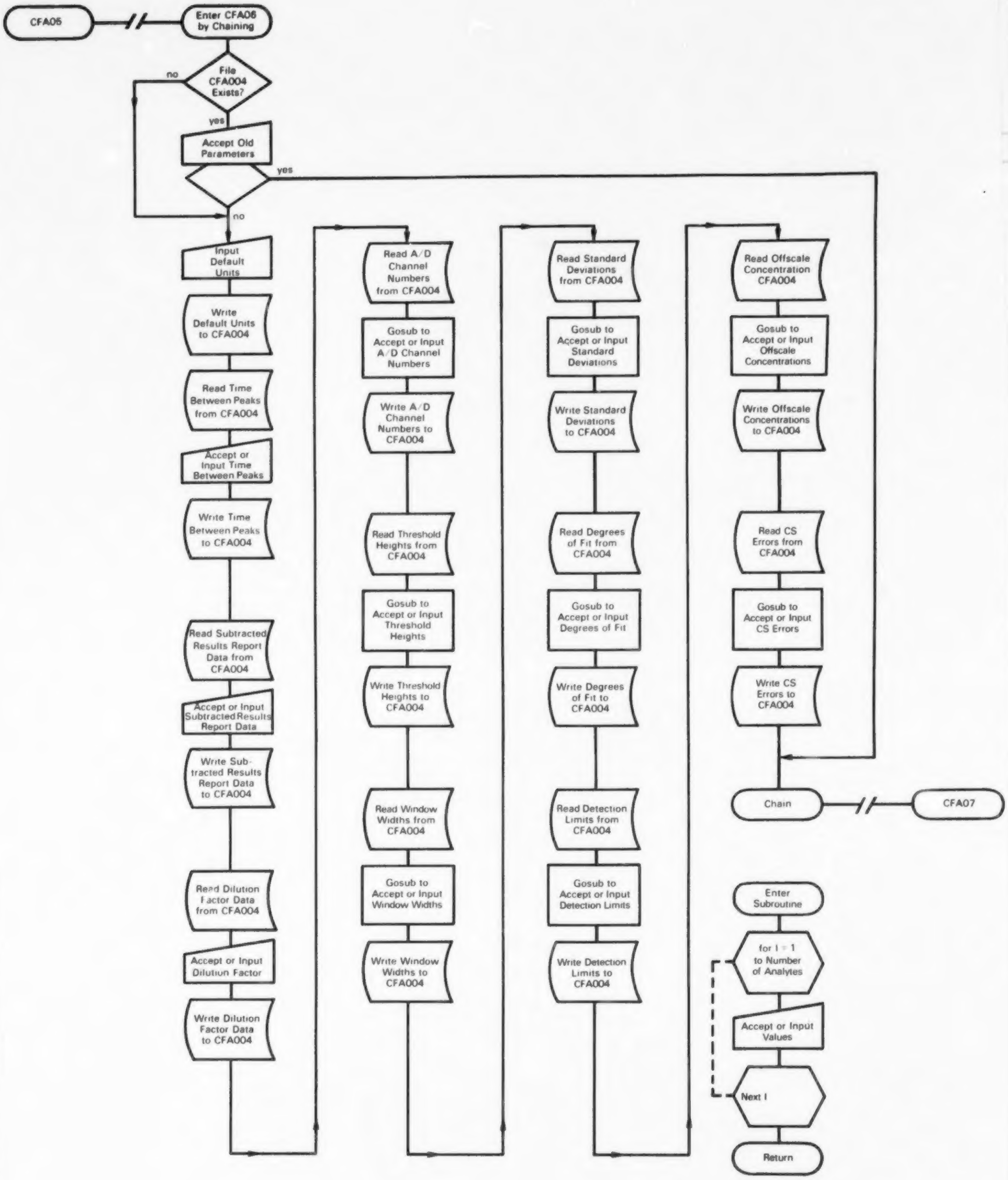
CFA05
Enter CFA06 by Chaining
File CFA004 Exists?
no
yes
Accept Old Parameters
yes
no
Input Default Units
Write Default Units to CFA004
Read Time Between Peaks from CFA004
Accept or Input Time Between Peaks
Write Time Between Peaks to CFA004
Read Subtracted Results Report Data from CFA004
Accept or Input Subtracted Results Report Data
Write Subtracted Results Report Data to CFA004
Read Dilution Factor Data from CFA004
Accept or Input Dilution Factor
Write Dilution Factor Data to CFA004
Read A/D Channel Numbers from CFA004
Gosub to Accept or Input A/D Channel Numbers
Write A/D Channel Numbers to CFA004
Read Threshold Heights from CFA004
Gosub to Accept or Input Threshold Heights
Write Threshold Heights to CFA004
Read Window Widths from CFA004
Gosub to Accept or Input Window Widths
Write Window Widths to CFA004
Read Standard Deviations from CFA004
Gosub to Accept or Input Standard Deviations
Write Standard Deviations to CFA004
Read Degrees of Fit from CFA004
Gosub to Accept or Input Degrees of Fit
Write Degrees of Fit to CFA004
Read Detection Limits from CFA004
Gosub to Accept or Input Detection Limits
Write Detection Limits to CFA004
Read Offscale Concentration CFA004
Gosub to Accept or Input Offscale Concentrations
Write Offscale Concentrations to CFA004
Read CS Errors from CFA004
Gosub to Accept or Input CS Errors
Write CS Errors to CFA004
Chain
CFA07
Enter Subroutine
for I = 1 to Number of Analytes
Accept or Input Values
Next I
Return

Figure 8. Functional Flowchart for Program CFA06.

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(4-76)

TABLE 7. SYMBOL DEFINITIONS FOR CFA06

A$	the user's answer to several questions
A2$	the superstring of the parameter-method codes
A3$	a multi-purpose string of formatted data
B6()	the array of automation parameters where each array position represents a different analyte
D	the additional dilution factor for offscale samples
I	the control variable for loops
N	the number of analytes
R6	the flag for the subtracted results report (0 = no report; 1 = yes)
R7	the position in A2$ of the parameter-method code for the minuend compound
R8	the position in A2$ of the parameter-method code for the subtrahend compound
T4	the time between peaks, in seconds
U$	the superstring of default concentration units
X9	the flag to indicate whether the program is updating an old CFA004 file or generating a new one (0 = generate; 1 = update)

```
C-O-N-T-I-N-U-O-U-S   F-L-O-W   A-N-A-L-Y-Z-E-R   A-U-T-O   S-Y-S-T-E-M
5/23/1980                                                         PAGE  1
                      PROGRAM LISTING FOR CFA06

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
0010 REM   +=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+
0020 REM   +   CONTINUOUS FLOW ANALYZER AUTOMATION SYSTEM               +
0030 REM   +   PROGRAM CFA06, AUTOMATION PARAMETER GATHERER             +
0040 REM   +   BY:  J. KOPKE (UCCC)      FEBRUARY 1, 1980               +
0050 REM   +   MOST RECENT REVISION:  APRIL 15, 1980                    +
0060 REM   +=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+
0070 REM
0080 DIM A2$[21],A3$[21],A$[10],U$[3]
0090 DIM F6$[10]
0100 ON ESC THEN GOTO 0130
0110 ESC
0120 GOTO 0160
0130 NOESC
0140 CLOSE
0150 CHAIN "CFA00"
0160 READ FILE[4,0],N,A2$
0170 CLOSE FILE[4]
0180 ON ERR THEN GOTO 0200
0190 RENAME "CFA004","CFA004"
0200 ON ERR THEN STOP
0210 IF SYS(7)=-10 THEN GOTO 0460
0220 OPEN FILE[5,0],"CFA004",22
0230 READ FILE[5,0],A3$
0240 IF A3$=A2$ THEN GOTO 0320
0250 CLOSE FILE[5]
0260 DELETE "CFA004"
0270 GOTO 0460
0280 PRINT
0290 PRINT "H = HELP"
0300 PRINT "A = ACCEPT ALL EXISTING AUTOMATION PARAMETERS"
0310 PRINT "U = UPDATE AUTOMATION PARAMETERS"
0320 PRINT
0330 ON ERR THEN GOTO 0350
0340 INPUT "AUTOMATION PARAMETERS ([H],A,U) >>  ",A$
0350 ON ERR THEN STOP
0360 IF A$="" THEN GOTO 0280
0370 IF A$="H" THEN GOTO 0280
0380 IF A$="A" THEN GOTO 2880
0390 IF A$="U" THEN GOTO 0480
0400 PRINT
0410 PRINT "<7>INVALID RESPONSE"
0420 GOTO 0280

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
```

```
C-O-N-T-I-N-U-O-U-S   F-L-O-W   A-N-A-L-Y-Z-E-R   A-U-T-O   S-Y-S-T-E-M
5/23/1980                                                         PAGE  2
                      PROGRAM LISTING FOR CFA06

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
0430 REM   --------------------------------------------------------------
0440 REM          FILE CFA004 HOUSEKEEPING
0450 LET X9=0
0460 OPEN FILE[5,0],"CFA004",22
0470 GOTO 0490
0480 LET X9=1
0490 ON ESC THEN GOTO 0510
0500 GOTO 0580
0510 NOESC
0520 CLOSE
0530 DELETE "CFA004"
0540 PRINT
0550 PRINT "<7>ALL AUTOMATION PARAMETERS HAVE BEEN DELETED BECAUSE THE
*    Y"
0560 PRINT "     WERE INCOMPLETE"
0570 CHAIN "CFA00"
0580 IF X9=0 THEN WRITE FILE[5,0],A2$
0590 REM   --------------------------------------------------------------
0600 REM          DEFAULT UNITS
0610 PRINT
0620 PRINT "DEFAULT CONCENTRATION UNITS:"
0630 FOR I=1 TO N
0640   GOTO 0700
0650   PRINT
0660   PRINT "H = HELP"
0670   PRINT "M = MILLIGRAMS PER LITER"
0680   PRINT "U = MICROGRAMS PER LITER"
0690   PRINT
0700   PRINT "     ";A2$[I*7-6,I*7];
0710   ON ERR THEN GOTO 0730
0720   INPUT " ([H],M,U) >>  ",A$
0730   ON ERR THEN STOP
0740   IF A$="" THEN GOTO 0650
0750   IF A$="H" THEN GOTO 0650
0760   IF A$="M" THEN GOTO 0810
0770   IF A$="U" THEN GOTO 0810
0780   PRINT
0790   PRINT "<7>     INVALID RESPONSE"
0800   GOTO 0650
0810   LET U$=U$,A$
0820 NEXT I
0830 REM   --------------------------------------------------------------

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
```

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(4-76)

```
C-O-N-T-I-N-U-O-U-S   F-L-O-W   A-N-A-L-Y-Z-E-R   A-U-T-O   S-Y-S-T-E-M
5/23/1980                                                      PAGE  3
                     PROGRAM LISTING FOR CFA06

 1234567891123456789212345678931234567894123456789512345678961234567897
          0         0         0         0         0         0         0
0840 REM          TIME BETWEEN PEAKS
0850 PRINT
0860 PRINT "TIME BETWEEN PEAKS, IN SECONDS";
0870 IF X9=0 THEN GOTO 0910
0880 READ FILE[5,1],T4
0890 PRINT USING " ([###.#]",T4;
0900 PRINT ",---)";
0910 ON ERR THEN GOTO 0930
0920 INPUT " >>  ",A$
0930 ON ERR THEN STOP
0940 IF X9=1 THEN IF A$="" THEN GOTO 1030
0950 LET T4=-99999
0960 ON ERR THEN GOTO 0980
0970 LET T4=VAL(A$)
0980 ON ERR THEN STOP
0990 IF T4>0 THEN GOTO 1030
1000 PRINT
1010 PRINT "<7>INVALID RESPONSE"
1020 GOTO 0850
1030 WRITE FILE[5,1],T4,U$
1040 REM ---------------------------------------------------------------
1050 REM          SUBTRACTED RESULTS REPORT
1060 IF N=1 THEN GOTO 1170
1070 PRINT
1080 ON ERR THEN GOTO 1100
1090 INPUT "SUBTRACTED RESULTS REPORT ([N],Y) >>  ",A$
1100 ON ERR THEN STOP
1110 IF A$="" THEN GOTO 1170
1120 IF A$="N" THEN GOTO 1170
1130 IF A$="Y" THEN GOTO 1190
1140 PRINT
1150 PRINT "<7>INVALID RESPONSE"
1160 GOTO 1060
1170 WRITE FILE[5,2],0,0,0
1180 GOTO 1640
1190 PRINT "      MINUEND ANALYTE";
1200 IF X9=0 THEN GOTO 1240
1210 READ FILE[5,2],R6,R7,R8
1220 IF R6=0 THEN GOTO 1240
1230 PRINT " (["; A2$[R7*7-6,R7*7];"],---)";
1240 ON ERR THEN GOTO 1260
1250 INPUT " >>  ",A$

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
```

```
C-O-N-T-I-N-U-O-U-S   F-L-O-W   A-N-A-L-Y-Z-E-R   A-U-T-O   S-Y-S-T-E-M
5/23/1980                                                      PAGE
                     PROGRAM LISTING FOR CFA06

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
1260 ON ERR THEN STOP
1270 IF X9=1 THEN IF R6<>0 THEN IF A$="" THEN GOTO 1400
1280 IF LEN(A$)>7 THEN GOTO 1350
1290 IF LEN(A$)=7 THEN GOTO 1320
1300 LET A$=A$," "
1310 GOTO 1290
1320 FOR I=1 TO N
1330   IF A$=A2$[I*7-6,I*7] THEN GOTO 1390
1340 NEXT I
1350 PRINT
1360 PRINT "<7>     INVALID RESPONSE"
1370 PRINT
1380 GOTO 1190
1390 LET R7=I
1400 PRINT "      SUBTRAHEND ANALYTE";
1410 IF X9=0 THEN GOTO 1440
1420 IF R6=0 THEN GOTO 1440
1430 PRINT " ([";A2$[R8*7-6,R8*7];"],---)";
1440 ON ERR THEN GOTO 1460
1450 INPUT " >>  ",A$
1460 ON ERR THEN STOP
1470 IF X9=1 THEN IF R6<>0 THEN IF A$="" THEN GOTO 1600
1480 IF LEN(A$)>7 THEN GOTO 1550
1490 IF LEN(A$)=7 THEN GOTO 1520
1500 LET A$=A$," "
1510 GOTO 1490
1520 FOR I=1 TO N
1530   IF A$=A2$[I*7-6,I*7] THEN GOTO 1590
1540 NEXT I
1550 PRINT
1560 PRINT "<7>     INVALID RESPONSE"
1570 PRINT
1580 GOTO 1400
1590 LET R8=I
1600 IF R8=R7 THEN GOTO 1550
1610 WRITE FILE[5,2],1,R7,R8
1620 REM ---------------------------------------------------------------
1630 REM          DILUTION FACTOR FOR OFFSCALE SAMPLE
1640 GOTO 1690
1650 PRINT
1660 PRINT "H = HELP"
1670 PRINT "F = FIXED DILUTION FACTOR WILL BE USED FOR ALL OFFSCALE SA
*    MPLES"

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
```

```
1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
1680 PRINT "V = VARIABLE DILUTION FACTOR WILL BE PRESCRIBED FOR EACH O
*    FFSCALE SAMPLE"
1690 PRINT
1700 ON ERR THEN GOTO 1720
1710 INPUT "OFFSCALE SAMPLE DILUTION PROCEDURE ([H],F,V) >>  ",A$
1720 ON ERR THEN STOP
1730 IF A$="" THEN GOTO 1650
1740 IF A$="H" THEN GOTO 1650
1750 IF A$="F" THEN GOTO 1800
1760 IF A$="V" THEN GOTO 1990
1770 PRINT
1780 PRINT "<7>INVALID RESPONSE"
1790 GOTO 1650
1800 IF X9=1 THEN READ FILE[5,3],D
1810 PRINT "      ADDITIONAL DILUTION FACTOR FOR OFFSCALE SAMPLES";
1820 IF X9=0 THEN GOTO 1860
1830 IF D=0 THEN GOTO 1860
1840 PRINT USING "([####.#]",D;
1850 PRINT ",——)";
1860 ON ERR THEN GOTO 1880
1870 INPUT " >>  ",A$
1880 ON ERR THEN STOP
1890 IF X9=1 THEN IF A$="" THEN GOTO 2030
1900 LET D=-99999
1910 ON ERR THEN GOTO 1930
1920 LET D=VAL(A$)
1930 ON ERR THEN STOP
1940 IF D>0 THEN GOTO 2000
1950 PRINT
1960 PRINT "<7>     INVALID RESPONSE"
1970 PRINT
1980 GOTO 1800
1990 LET D=0
2000 WRITE FILE[5,3],D
2010 REM  ——————————————————————————————————————————————————————
2020 REM          A/D CHANNEL NUMBERS
2030 DIM B6[N]
2040 IF X9=1 THEN MAT READ FILE[5,4],B6
2050 PRINT
2060 PRINT "A/D CHANNEL NUMBER:"
2070 LET F6$="##"
2080 GOSUB 2930

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
```

```
1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
2090 FOR I=1 TO N
2100   IF B6[I]=INT(B6[I]) THEN GOTO 2140
2110   PRINT
2120   PRINT "<7>INVALID RESPONSE"
2130   GOTO 2040
2140 NEXT I
2150 MAT WRITE FILE[5,4],B6
2160 REM  ——————————————————————————————————————————————————————
2170 REM          SET STANDARD THRESHOLD
2180 IF X9=1 THEN MAT READ FILE[5,5],B6
2190 PRINT
2200 PRINT "SET STANDARD THRESHOLD HEIGHT, IN PERCENT OF FULL SCALE:"
2210 LET F6$="##"
2220 GOSUB 2930
2230 MAT WRITE FILE[5,5],B6
2240 REM  ——————————————————————————————————————————————————————
2250 REM          WINDOW WIDTH
2260 IF X9=1 THEN MAT READ FILE[5,6],B6
2270 PRINT
2280 PRINT "DATA ACQUISITION WINDOW WIDTH, IN SECONDS:"
2290 LET F6$="###"
2300 GOSUB 2930
2310 FOR I=1 TO N
2320   IF B6[I]<.95*T4 THEN GOTO 2360
2330   PRINT
2340   PRINT "<7>INVALID RESPONSE"
2350   GOTO 2260
2360 NEXT I
2370 MAT WRITE FILE[5,6],B6
2380 REM  ——————————————————————————————————————————————————————
2390 REM          STANDARD DEVIATION DEFINING LEVELNESS
2400 IF X9=1 THEN MAT READ FILE[5,7],B6
2410 PRINT
2420 PRINT "STANDARD DEVIATION DEFINING LEVELNESS, IN PERCENT OF FULL
*    SCALE:"
2430 LET F6$="##.#"
2440 GOSUB 2930
2450 MAT WRITE FILE[5,7],B6
2460 REM  ——————————————————————————————————————————————————————
2470 REM          DEGREE OF FIT
2480 IF X9=1 THEN MAT READ FILE[5,8],B6
2490 PRINT

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
```

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```
C-O-N-T-I-N-U-O-U-S  F-L-O-W  A-N-A-L-Y-Z-E-R  A-U-T-O  S-Y-S-T-E-M
5/23/1980                                                  PAGE  7
                    PROGRAM LISTING FOR CFA06

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
 2500 PRINT "DEGREE OF LEAST SQUARES FIT (0=INTERPOLATION):"
 2510 LET F6$="#"
 2520 GOSUB 2930
 2530 FOR I=1 TO N
 2540   IF B6[I]=INT(B6[I]) THEN IF B6[I]>=0 THEN IF B6[I]<=3 THEN GOTO
*       2580
 2550   PRINT
 2560   PRINT "<7>INVALID RESPONSE"
 2570   GOTO 2480
 2580 NEXT I
 2590 MAT WRITE FILE[5,8],B6
 2600 REM  ---------------------------------------------------------------
 2610 REM            DETECTION LIMIT
 2620 IF X9=1 THEN MAT READ FILE[5,9],B6
 2630 PRINT
 2640 PRINT "DETECTION LIMIT, IN DEFAULT UNITS:"
 2650 LET F6$="###.###"
 2660 GOSUB 2930
 2670 MAT WRITE FILE[5,9],B6
 2680 REM  ---------------------------------------------------------------
 2690 REM           OFFSCALE CONCENTRATION
 2700 IF X9=1 THEN MAT READ FILE[5,10],B6
 2710 PRINT
 2720 PRINT "OFFSCALE CONCENTRATION, IN DEFAULT UNITS:"
 2730 LET F6$="####.###"
 2740 GOSUB 2930
 2750 MAT WRITE FILE[5,10],B6
 2760 REM  ---------------------------------------------------------------
 2770 REM           CHECK STANDARD ALLOWABLE ERROR
 2780 IF X9=1 THEN MAT READ FILE[5,11],B6
 2790 PRINT
 2800 PRINT "ALLOWABLE ERROR FOR INSTRUMENT CHECK STANDARDS, IN PERCENT
*     :"
 2810 LET A6$="##.#"
 2820 GOSUB 2930
 2830 MAT WRITE FILE[5,11],B6
 2840 CLOSE
 2850 GOTO 0180
 2860 REM  ---------------------------------------------------------------
 2870 REM           WRAP-UP PROCEDURE
 2880 NOESC
 2890 CLOSE

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
```

```
C-O-N-T-I-N-U-O-U-S  F-L-O-W  A-N-A-L-Y-Z-E-R  A-U-T-O  S-Y-S-T-E-M
5/23/1980                                                  PAGE  8
                    PROGRAM LISTING FOR CFA06

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
 2900 CHAIN "CFA07"
 2910 REM  +++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
 2920 REM            SUBROUTINE TO INPUT MULTIPLE PARAMETERS
 2930 FOR I=1 TO N
 2940   PRINT "     ";A2$[I*7-6,I*7];
 2950   IF X9=0 THEN GOTO 2990
 2960   PRINT " ([";
 2970   PRINT USING F6$,B6[I];
 2980   PRINT "],---)";
 2990   ON ERR THEN GOTO 3010
 3000   INPUT " >>  ",A$
 3010   ON ERR THEN STOP
 3020   IF X9=1 THEN IF A$="" THEN GOTO 3120
 3030   LET B6[I]=-99999
 3040   ON ERR THEN GOTO 3060
 3050   LET B6[I]=VAL(A$)
 3060   ON ERR THEN STOP
 3070   IF B6[I]>=0 THEN GOTO 3120
 3080   PRINT
 3090   PRINT "<7>     INVALID RESPONSE"
 3100   PRINT
 3110   GOTO 2940
 3120 NEXT I
 3130 RETURN

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
```

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```
C-O-N-T-I-N-U-O-U-S  F-L-O-W  A-N-A-L-Y-Z-E-R  A-U-T-O  S-Y-S-T-E-M
5/23/1980                                                PAGE  9
                  SYMBOL TABLE FOR CFA06

SYMBOL   REFERENCES
------   -------------------------------------------------------------

 0130   0100
 0160   0120
 0180   2850
 0200   0180
 0280   0360   0370   0420
 0320   0240
 0350   0330
 0460   0210   0270
 0480   0390
 0490   0470
 0510   0490
 0580   0500
 0650   0740   0750   0800
 0700   0640
 0730   0710
 0810   0760   0770
 0850   1020
 0910   0870
 0930   0910
 0980   0960
 1030   0940   0990
 1060   1160
 1100   1080
 1170   1060   1110   1120
 1190   1130   1380
 1240   1200   1220
 1260   1240
 1290   1310
 1320   1290
 1350   1280
 1390   1330
 1400   1270   1580
 1440   1410   1420
 1460   1440
 1490   1510
 1520   1490
 1550   1480   1600
 1590   1530
 1600   1470
 1640   1180
 1650   1730   1740   1790
 1690   1640
 1720   1700
 1800   1750   1980
 1860   1820   1830
```

```
C-O-N-T-I-N-U-O-U-S  F-L-O-W  A-N-A-L-Y-Z-E-R  A-U-T-O  S-Y-S-T-E-M
5/23/1980                                                PAGE 10
                  SYMBOL TABLE FOR CFA06

SYMBOL   REFERENCES
------   -------------------------------------------------------------

 1880   1860
 1930   1910
 1990   1760
 2000   1940
 2030   1890
 2040   2130
 2140   2100
 2260   2350
 2360   2320
 2480   2570
 2580   2540
 2880   0380
 2930   2080   2220   2300   2440   2520   2660   2740   2820
 2940   3110
 2990   2950
 3010   2990
 3060   3040
 3120   3020   3070
 A$     0080   0340   0360   0370   0380   0390   0720   0740   0750   0760
        0770   0810   0920   0940   0970   1090   1110   1120   1130   1250
        1270   1280   1290   1300   1330   1450   1470   1480   1490   1500
        1530   1710   1730   1740   1750   1760   1870   1890   1920   3000
        3020   3050
 A2$    0080   0160   0240   0580   0700   1230   1330   1430   1530   2940
 A3$    0080   0230   0240
 A6$    2810
 B6     2040   2150   2180   2230   2260   2370   2400   2450   2480   2590
        2620   2670   2700   2750   2780   2830
 B6[    2030   2100   2320   2540   2970   3030   3050   3070
 D      1800   1830   1840   1900   1920   1940   1990   2000
 F6$    0090   2070   2210   2290   2430   2510   2650   2730   2970
 FL#4   0160   0170
 FL#5   0220   0230   0250   0460   0880   1030   1170   1210   1610   2000
        2150   2230   2370   2450   2590   2670   2750   2830
 I      0630   0700   0820   1320   1330   1340   1390   1520   1530   1540
        1590   2090   2100   2140   2310   2320   2360   2530   2540   2580
        2930   2940   2970   3030   3050   3070   3120
 N      0160   0630   1060   1320   1520   2030   2090   2310   2530   2930
 R6     1210   1220   1270   1420   1470
 R7     1210   1230   1390   1600   1610
 R8     1210   1430   1590   1600   1610
 T4     0880   0890   0950   0970   0990   1030   2320
 U$     0080   0810   1030
 X9     0450   0480   0580   0870   0940   1200   1270   1410   1470   1800
        1820   1890   2040   2180   2260   2400   2480   2620   2700   2780
```

```
C-O-N-T-I-N-U-O-U-S   F-L-O-W   A-N-A-L-Y-Z-E-R   A-U-T-O   S-Y-S-T-E-M
5/23/1980                                                       PAGE 11
                       SYMBOL TABLE FOR CFA06

SYMBOL    REFERENCES
------  --------------------------------------------------------------
          2950  3020
```

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SECTION 9

PROGRAM CFA07 - REAL-TIME PROGRAM STARTER

CFA07 is the program which starts the data acquisition process. It can be entered by chaining from either CFA00 or CFA06. It chains back to CFA00 if the ESCAPE key is pressed.

If a user attempts to restart a run which was never started normally before, the files CFA003 and CFA004 will be in disorder or may not exist at all. Therefore, CFA07 first checks whether the files exist and match. If they do not, the user is instructed to start the run over using the "S" option at CFA master command level.

The program then waits at an INPUT statement while the user sets the detectors to full scale. CALL 6 is then used to access the analogue to digital (A/D) converter readings for full scale. Similarly, CALL 6 is then used to collect the A/D converter readings at proper damping. The program checks whether the readings for full scale are least 2000 A/D counts higher than those for proper damping to ensure that the hardware is connected and working properly. The readings are then placed into file CFA004.

Next, the program reads the automation parameters from the file CFA004, and uses them to create the arrays to be passed to the real-time assembly language routines. CALL 16 is used to initialize the real-time parameter tables.[3]

The user is then asked to specify whether the automated run is attended or unattended, and the choice is flagged in CFA004.

The program then waits at an INPUT statement until the user presses RETURN to indicate that it should begin the search for the first timing set standard. CALL 20 is used to begin the data taking process.

Finally, the program prints the headings for the progress report, and chains to CFA08.

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TOP OF IMAGE AREA
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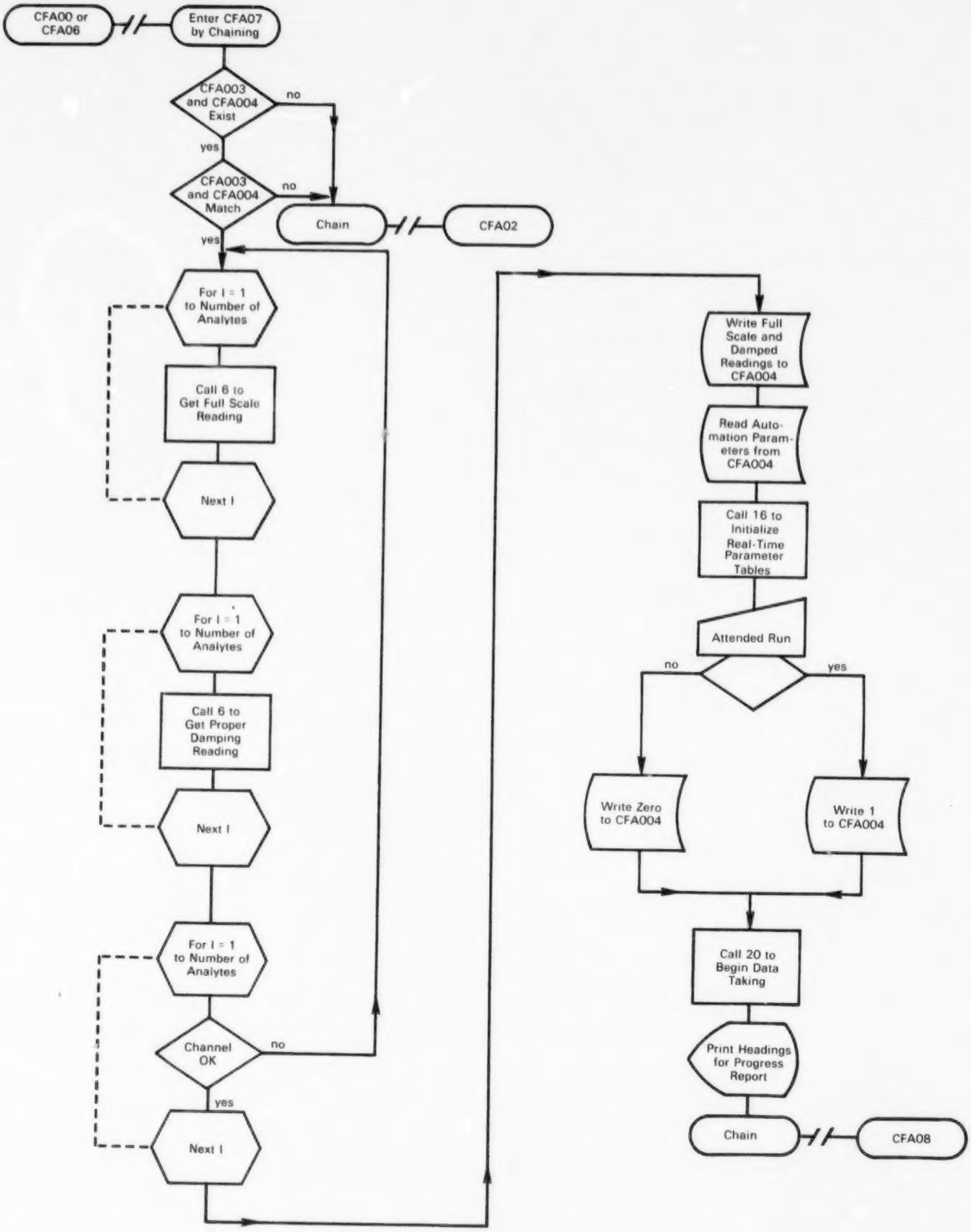
CFA00 or CFA06
Enter CFA07 by Chaining
CFA003 and CFA004 Exist
no
yes
CFA003 and CFA004 Match
no
Chain
CFA02
yes
For I = 1 to Number of Analytes
Call 6 to Get Full Scale Reading
Next I
For I = 1 to Number of Analytes
Call 6 to Get Proper Damping Reading
Next I
For I = 1 to Number of Analytes
Channel OK
no
yes
Next I
Write Full Scale and Damped Readings to CFA004
Read Automation Parameters from CFA004
Call 16 to Initialize Real-Time Parameter Tables
Attended Run
no
yes
Write Zero to CFA004
Write 1 to CFA004
Call 20 to Begin Data Taking
Print Headings for Progress Report
Chain
CFA08

Figure 9. Functional Flowchart for Program CFA07.

BOTTOM OF IMAGE AREA; OUTSIDE DIMENSION FOR TABLES AND ILLUSTRATIONS
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PAGE NUMBER
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(6-76)

TABLE 8. SYMBOL DEFINITIONS FOR CFA07

A$	the user's answer to several questions
A2$	the superstring of parameter-method codes
A3$	a general purpose string of formatted data
B4()	the array of A/D channel numbers followed by a -1 used in CALL 16
B5()	the array of A/D channel numbers
B6()	the array of threshold heights for set standards, in percent of full scale
B7()	the array of A/D converter readings at full scale
B8()	the array of A/D converter headings at proper damping
I	the control variable for loops
N	the number of analytes
P()	the array of real-time parameters used in CALL 16
R9$	the name of the run file
S()	the array of data specific to one analyte for a wheel position; see symbol definitions for CFA03
T4	the time between peaks, in seconds
W	the number of wheel positions occupied by the batch
X7	the number of A/D converter readings to be averaged by CALL 6

```
C-O-N-T-I-N-U-O-U-S   F-L-O-W   A-N-A-L-Y-Z-E-R   A-U-T-O   S-Y-S-T-E-M
5/23/1980                                                         PAGE  1
                     PROGRAM LISTING FOR CFA07

 12345678911234567892123456789312345678941234567895123456789612345678970
          0         0         0         0         0         0         0
0010 REM    +=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+
0020 REM    +   CONTINUOUS FLOW ANALYZER AUTOMATION SYSTEM              +
0030 REM    +   PROGRAM CFA07, REAL-TIME PROGRAM STARTER                +
0040 REM    +   BY:  J. KOPKE (UCCC)      FEBRUARY 4, 1980              +
0050 REM    +   MOST RECENT REVISION:  APRIL 15, 1980                   +
0060 REM    +=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+
0070 REM
0080 DIM A$[1],A2$[22],A3$[79],R9$[13],S[14]
0090 ON ESC THEN GOTO 0120
0100 ESC
0110 GOTO 0160
0120 CLOSE
0130 CALL 17
0140 NOESC
0150 CHAIN "CFA00"
0160 ON ERR THEN GOTO 0200
0170 DELETE "CFA006"
0180 ON ERR THEN STOP
0190 GOTO 0260
0200 IF SYS(7)<>-48 THEN GOTO 0260
0210 PRINT
0220 PRINT "<7>THE SYSTEM CANNOT PROCEED WHILE THE SECOND-TERMINAL CAL
*    IBRATION"
0230 PRINT "REPORT/PLOT FEATURE IS IN USE;  THERE WILL BE A 10-SECOND
*    DELAY"
0240 DELAY =10
0250 GOTO 0160
0260 ON ERR THEN GOTO 0280
0270 RENAME "CFA003","CFA003"
0280 ON ERR THEN STOP
0290 IF SYS(7)=-10 THEN GOTO 0350
0300 ON ERR THEN GOTO 0320
0310 RENAME "CFA004","CFA004"
0320 ON ERR THEN STOP
0330 IF SYS(7)=-10 THEN GOTO 0350
0340 GOTO 0410
0350 PRINT
0360 PRINT "<7>THE SYSTEM DOES NOT HAVE SUFFICIENT DATA TO BEGIN THIS
*    AUTOMATED RUN"
0370 PRINT "AT THIS POINT;  USE THE 'S' COMMAND OF THE CFA MASTER"
0380 PRINT "COMMAND LEVEL TO START THIS RUN"
0390 NOESC

 12345678911234567892123456789312345678941234567895123456789612345678970
          0         0         0         0         0         0         0
```

```
C-O-N-T-I-N-U-O-U-S   F-L-O-W   A-N-A-L-Y-Z-E-R   A-U-T-O   S-Y-S-T-E-M
5/23/1980                                                         PAGE  2
                     PROGRAM LISTING FOR CFA07

 12345678911234567892123456789312345678941234567895123456789612345678970
          0         0         0         0         0         0         0
0400 CHAIN "CFA00"
0410 OPEN FILE[4,0],"CFA003",56
0420 OPEN FILE[5,0],"CFA004",22
0430 READ FILE[4,0],N,A2$,R9$,W
0440 ON ERR THEN GOTO 0460
0450 RENAME R9$,R9$
0460 ON ERR THEN STOP
0470 IF SYS(7)<>-9 THEN GOTO 0500
0480 READ FILE[5,0],A3$
0490 IF A2$=A3$ THEN GOTO 0540
0500 CLOSE
0510 GOTO 0350
0520 REM    ----------------------------------------------------------
0530 REM           GET FULL SCALE AND PROPER DAMPING READINGS
0540 DIM B4[N+1],B5[N],B6[N],B7[N],B8[N],P[N*5]
0550 MAT READ FILE[5,4],B5
0560 MAT B7=ZER
0570 MAT B8=ZER
0580 PRINT
0590 ON ERR THEN GOTO 0610
0600 INPUT "SET ALL DETECTORS TO FULL SCALE;  THEN PRESS 'RETURN' >>
*    ",A$
0610 ON ERR THEN STOP
0620 LET X7=15
0630 FOR I=1 TO N
0640   CALL 6,B5[I],X7,B7[I]
0650 NEXT I
0660 ON ERR THEN GOTO 0680
0670 INPUT "SET ALL DETECTORS TO PROPER DAMPING;  THEN PRESS 'RETURN'
*    >>  ",A$
0680 ON ERR THEN STOP
0690 FOR I=1 TO N
0700   CALL 6,B5[I],X7,B8[I]
0710 NEXT I
0720 FOR I=1 TO N
0730   IF B7[I]-B8[I]>3000 THEN GOTO 0770
0740   PRINT
0750   PRINT USING "<7>A/D CHANNEL ## FOR ####### IS NOT WORKING PROPE
*    RLY",B5[I],A2$[I*7-6,I*7]
0760   GOTO 0580
0770 NEXT I
0780 MAT WRITE FILE[5,12],B7

 12345678911234567892123456789312345678941234567895123456789612345678970
          0         0         0         0         0         0         0
```

```
C-O-N-T-I-N-U-O-U-S  F-L-O-W  A-N-A-L-Y-Z-E-R  A-U-T-O  S-Y-S-T-E-M
5/23/1980                                              PAGE  3
                     PROGRAM LISTING FOR CFA07

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
0790 MAT WRITE FILE[5,13],B8
0800 REM  ------------------------------------------------------------
0810 REM            INITIALIZE REAL-TIME CODE PARAMETER TABLES
0820 FOR I=1 TO N
0830   LET B4[I]=B5[I]
0840 NEXT I
0850 LET B4[N+1]=-1
0860 FOR I=1 TO N
0870   LET P[(I-1)*5+1]=10
0880   LET P[(I-1)*5+2]=3
0890 NEXT I
0900 MAT READ FILE[5,5],B6
0910 FOR I=1 TO N
0920   LET P[(I-1)*5+3]=B8[I]+B6[I]*(B7[I]-B8[I])*.01
0930 NEXT I
0940 READ FILE[5,1],T4
0950 FOR I=1 TO N
0960   LET P[(I-1)*5+4]=INT(T4*7.5)
0970 NEXT I
0980 MAT READ FILE[5,6],B6
0990 FOR I=1 TO N
1000   LET P[(I-1)*5+5]=INT(B6[I]/8)
1010 NEXT I
1020 CALL 16,B4[1],P[1]
1030 REM  ------------------------------------------------------------
1040 REM            MODE OF RUN
1050 PRINT
1060 ON ERR THEN GOTO 1080
1070 INPUT "ATTENDED RUN ([N],Y) >>  ",A$
1080 ON ERR THEN STOP
1090 IF A$="" THEN GOTO 1150
1100 IF A$="N" THEN GOTO 1150
1110 IF A$="Y" THEN GOTO 1170
1120 PRINT
1130 PRINT "<7>INVALID RESPONSE"
1140 GOTO 1050
1150 WRITE FILE[5,14],0
1160 GOTO 1200
1170 WRITE FILE[5,14],1
1180 REM  ------------------------------------------------------------
1190 REM            BEGIN DATA TAKING
1200 PRINT

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
```

```
C-O-N-T-I-N-U-O-U-S  F-L-O-W  A-N-A-L-Y-Z-E-R  A-U-T-O  S-Y-S-T-E-M
5/23/1980                                              PAGE  4
                     PROGRAM LISTING FOR CFA07

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
1210 ON ERR THEN GOTO 1230
1220 INPUT "PRESS 'RETURN' TO BEGIN DATA TAKING >>  ",A$
1230 ON ERR THEN STOP
1240 CALL 20
1250 PRINT
1260 PRINT "THE SYSTEM IS WAITING FOR THE FIRST SET STANDARD..."
1270 REM  -------------------------------------------------------------
1280 REM            PRINT HEADINGS FOR PROGRESS REPORT
1290 FOR I=1 TO 5
1300   PRINT
1310 NEXT I
1320 PRINT "                      P-R-O-G-R-E-S-S  R-E-P-O-R-T"
1330 LET A3$="                               DATE:  00/00/00"
1340 LET A3$[40-LEN(STR$(SYS(2))),39]=STR$(SYS(2))
1350 LET A3$[43-LEN(STR$(SYS(1))),42]=STR$(SYS(1))
1360 LET A3$[46-LEN(STR$(SYS(3)-1900)),45]=STR$(SYS(3)-1900)
1370 PRINT A3$
1380 PRINT
1390 LET A3$="  WHEEL       SAMPLE   DILUTION    "
1400 FOR I=1 TO N
1410   LET A3$=A3$,"    ",A2$[I*7-6,I*7]
1420 NEXT I
1430 PRINT A3$
1440 LET A3$=" POSITION       TYPE     FACTOR    "
1450 FOR I=1 TO N
1460   LET A3$=A3$,"   RESULTS"
1470 NEXT I
1480 PRINT A3$
1490 LET A3$="---------  ----------  ------      "
1500 FOR I=1 TO N
1510   LET A3$=A3$,"  -------"
1520 NEXT I
1530 PRINT A3$
1540 REM  -------------------------------------------------------------
1550 REM            WRAP-UP PROCEDURE
1560 FOR I=1 TO W
1570   FOR J=1 TO N
1580     MAT READ FILE[4,(I-1)*(N+1)+1+J],S
1590     LET S[1]=-99999
1600     MAT WRITE FILE[4,(I-1)*(N+1)+1+J],S
1610   NEXT J
1620 NEXT I

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
```

```
C-O-N-T-I-N-U-O-U-S   F-L-O-W   A-N-A-L-Y-Z-E-R   A-U-T-O   S-Y-S-T-E-M
5/23/1980                                                          PAGE  5
                    PROGRAM LISTING FOR CFA07

123456789112345678921234567893123456789412345678951234567896123456789 7
         0         0         0         0         0         0         0
1630 NOESC
1640 CHAIN "CFA08"









1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
```

```
C-O-N-T-I-N-U-O-U-S   F-L-O-W   A-N-A-L-Y-Z-E-R   A-U-T-O   S-Y-S-T-E-M
5/23/1980                                                          PAGE  6
                      SYMBOL TABLE FOR CFA07

SYMBOL    REFERENCES
------    ----------------------------------------------------------------
0120  0090
0160  0110  0250
0200  0160
0260  0190  0200
0280  0260
0320  0300
0350  0290  0330  0510
0410  0340
0460  0440
0500  0470
0540  0490
0580  0760
0610  0590
0680  0660
0770  0730
1050  1140
1080  1060
1150  1090  1100
1170  1110
1200  1160
1230  1210
A$    0080  0600  0670  1070  1090  1100  1110  1220
A2$   0080  0430  0490  0750  1410
A3$   0080  0480  0490  1330  1340  1350  1360  1370  1390  1410
      1430  1440  1460  1480  1490  1510  1530
B4[   0540  0830  0850  1020
B5    0550
B5[   0540  0640  0700  0750  0830
B6    0900  0980
B6[   0540  0920  1000
B7    0560  0780
B7[   0540  0640  0730  0920
B8    0570  0790
B8[   0540  0700  0730  0920
FL#4  0410  0430  1580  1600
FL#5  0420  0480  0550  0780  0790  0900  0940  0980  1150  1170
I     0630  0640  0650  0690  0700  0710  0720  0730  0750  0770
      0820  0830  0840  0860  0870  0880  0890  0910  0920  0930
      0950  0960  0970  0990  1000  1010  1290  1310  1400  1410
      1420  1450  1470  1500  1520  1560  1580  1600  1620
J     1570  1580  1600  1610
N     0430  0540  0630  0690  0720  0820  0850  0860  0910  0950
      0990  1400  1450  1500  1570  1580  1600
P[    0540  0870  0880  0920  0960  1000  1020
R9$   0080  0430  0450
```

```
C-O-N-T-I-N-U-O-U-S  F-L-O-W  A-N-A-L-Y-Z-E-R  A-U-T-O  S-Y-S-T-E-M
5/23/1980                                                    PAGE  7
                       SYMBOL TABLE FOR CFA07

SYMBOL    REFERENCES
------    ----------------------------------------------------------

  S       1580  1600
  S[      0080  1590
  T4      0940  0960
  W       0430  1560
  X7      0620  0640  0700
```

SECTION 10

PROGRAM CFA08 - DATA ACQUIRER AND REDUCER

CFA08 is the main data acquisition and reduction program. It is entered by chaining from program CFA07, and it chains back to CFA00 if the ESCAPE key is pressed. After the last calibration standard has been processed, this program chains to CFA09, where calibration is performed and the calibration curve plotting file is created. CFA09 chains back to the beginning of CFA08.

When CFA08 is first entered, it reads five arrays of automation parameters from file CFA004 and then checks whether the calibration curve plotting file, CFA006, exists. File CFA006 is always deleted by program CFA07 and is always created by program CFA09. Therefore, if file CFA006 does exist, the program has been entered from CFA09, and it branches back into the section concerning calibration standards. Otherwise the program begins an automated run by initializing five additional arrays of automation parameters and deleting and restarting the raw data file, CFA005. The program also scans the reduced data file, CFA003, and sets all of the peak heights equal to -99999 to enable subsequent programs to determine where an incomplete batch was interrupted. The data acquisition process is then begun.

RAW DATA ACQUISITION

The telemetry signal from the continuous flow analyzer normally ranges from 0 to 10 volts, direct current. This signal is differentially coupled at the instrument and transmitted to an analogue to digital converter which generates an integer between 0 and 16,383 (i.e. $2^{14} - 1$). The resulting numbers are directly proportional to the voltage of the telemetry signal, and consequently to the concentration of the analyte in the detector.

The Continuous Flow Analyzer Automation System collects readings from the analogue to digital converter by using assembly language routines developed at Lawrence Livermore Laboratory. Enhancements made at Livermore to the Data General BASIC allow CFA08 to call these assembly language routines while the multi-user nature of BASIC is maintained. The assembly language routines provide the flexibility needed to acquire data from the analogue to digital converter. Once they have been started by the CALL 16 and CALL 20 in CFA07, the assembly language routines are activated by interrupts from a real-time clock in the computer. Upon completion of an assembly language routine, control is returned to the BASIC program. The assembly language routines and the enhancements to BASIC have been extensively documented, as mentioned in Section 1.[3]

The sequence of events for data acquisition is as follows: CFA07 uses CALL 16 to pass parameters to the assembly language routines. The user-specified parameters include the rate at which readings are to be taken from the analogue to digital converter, the amount of time between peaks, and the threshold height for the first timing peak. The CALL 20 in CFA07 begins the search for the first peak. From this point on, the assembly language routine collects data from the analogue to digital converter at prescribed intervals of time. The time used by the assembly language routine is roughly 0.00005 seconds, so that no other users are noticeably affected.

It would be impractical for the assembly language routine to actually take readings from the analogue to digital converter constantly, however peak heights can be accurately determined in continuous flow analysis from readings taken 0.5 to 1.5 seconds apart. Therefore, the assembly language routine takes only sixty readings from the analogue to digital converter for each peak, and these sixty readings are evenly spaced throughout a "data acquisition window" centered on the top of the peak and having a width specified by the user.

The concept of a data acquisition window creates one additional complication, however, and that is the synchronization of the assembly language routines with the automatic sampler so that the data acquisition windows are centered on the tops of the peaks. For this reason, the first three samples of every batch have to be timing set standards. When CFA07 instructs the assembly language routine to begin looking for the first peak, the assembly language routine begins to take readings from the analogue to digital converter at the rate of once every four seconds. When it first encounters a reading higher than the threshold value specified by the user, the assembly language routine begins to take readings at the normal, user-specified rate. When the readings drop below the threshold value, the assembly language routine stops taking readings, and it calculates the amount of dead time which should transpire before the next data acquisition window begins. Thereafter, it is the responsibility of CFA08 to maintain timing synchronization by determining if the peaks are centered in the data acquisition windows and by instructing the assembly language routine to lengthen or shorten the dead time between windows, if necessary. The second and third timing set standards give CFA08 a chance to make fine adjustments to the timing synchronization before the important samples of the batch are dealt with.

After all of these preliminary operations are complete, the data acquisition process becomes repetitive. When CFA08 is ready for the sixty readings for the next peak, it calls the assembly language routine to provide them. Usually CFA08 is ready for more data long before the next sample reaches the detector. Therefore, the assembly language routine causes CFA08 to be suspended -- freeing more time for other users. When the assembly language program has acquired the sixty readings for the next peak, it "wakes up" CFA08, passes the sixty values to CFA08, and returns control to CFA08.

If for any reason, CFA08 gets behind, the assembly language routine is capable of backlogging the data for a set number of peaks until CFA08 can catch up. This backlogging feature is not used except in unavoidable circumstances however, since data acquisition window adjustments cannot be made on backlogged data. At the end of the automated run, CFA08 issues a CALL 17 to instruct the assembly language routine to stop, and that routine is no longer activated by the real-time clock.

For the convenience of the analysts, CFA08 performs a linear transformation of all of the analogue to digital converter readings into numbers representing a percentage of full scale, where the number of analogue to digital converted counts for proper damping becomes 0% of full scale, and the number of counts for full scale becomes 100% of full scale.

PEAK HEIGHT DETERMINATION

Two terms must be defined before the peak height determination algorithms can be discussed. The first of these is the word "level." In Figure 10A, the peak with a broad plateau has an obvious level region, and the peak in Figure 10B can be considered instantaneously level at its summit. However, a close examination of the analogue to digital converter readings for continuous flow analyzer peaks reveals that -- even for peaks with broad plateaus -- it is very unusual for any two consecutive readings to be precisely the same. Therefore, for this purpose, "level" cannot be defined simply as "having no part higher than another." Rather, reading number n of the sixty readings in the data acquisition window will be considered to be in a level place if the standard deviation of readings n-2, n-1, n, n+1, and n+2 is less than a user-specified amount.

The second term which must be defined is "smoothed value of reading." No peak height determination should be based on a single reading from the analogue to digital converter, since that one reading may be an outlier. The Continuous Flow Analyzer Automation System works with "smoothed values" which are determined by the following procedure: To calculate the smoothed value for reading number n, perform a least squares quadratic regression to readings n-2, n-1, n, n+1, and n+2, using the reading numbers as abscissas and the readings as ordinates. Substitute n into the resulting equation and solve for the smoothed value. The entire smoothing process is performed by one statement:

```
LET V = (D2[I-2]*(-3)+D2[I-1]*12+D2[I]*17+D2[I+1]*12+D2[I+2]*(-3))/35
```

Figure 11 is a flowchart of the peak height determination procedure. As that figure shows, CFA08 first acquires and transforms the sixty readings which were taken from the analogue to digital converter by the assembly language routine. The sixty readings are searched for a place that is level, as defined previously. If no level place can be found, the program does not attempt to determine a peak height. If there are several readings in level places, the program compares their smoothed values and locates the highest level reading.

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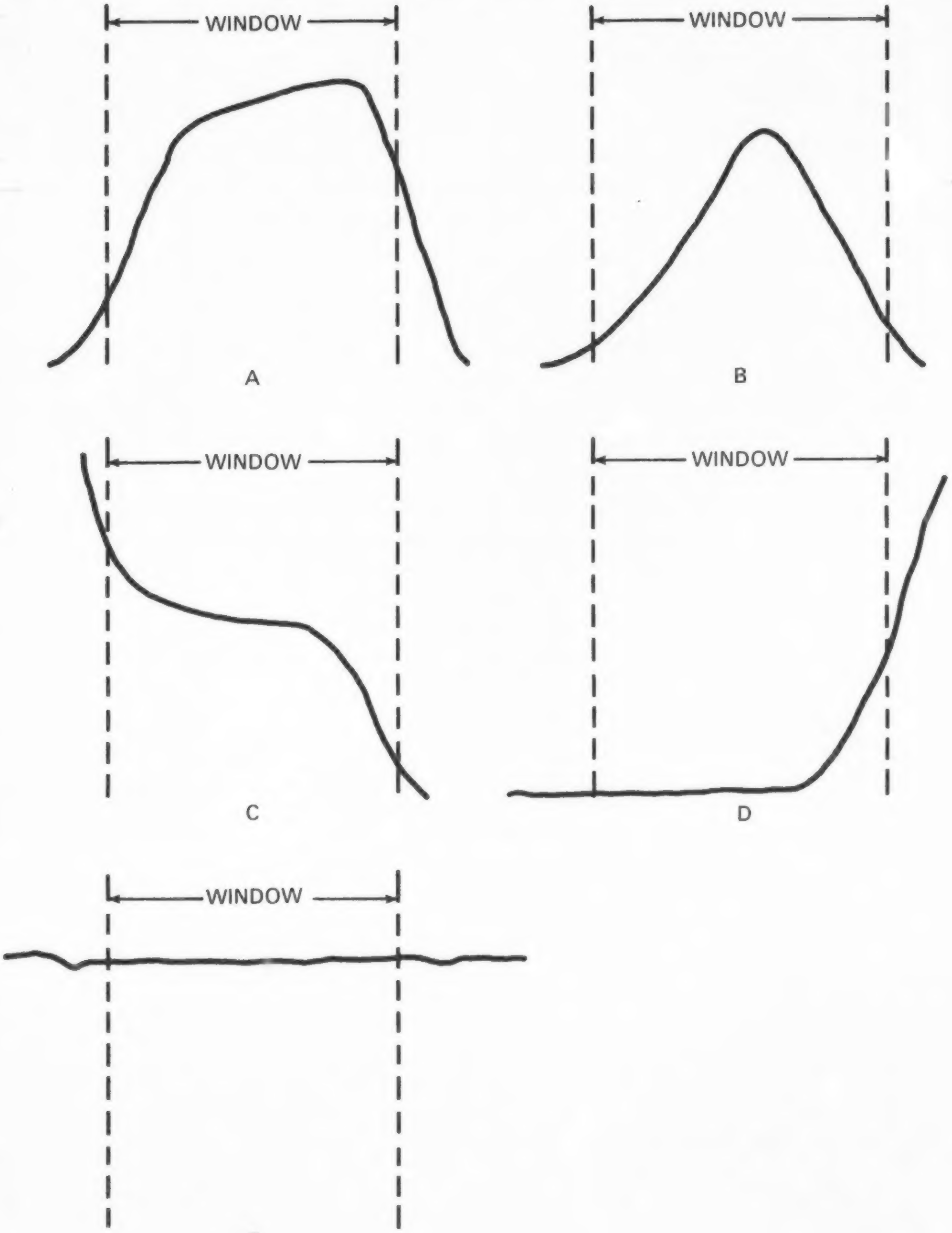
WINDOW
A
WINDOW
B
WINDOW
C
WINDOW
D
WINDOW
E

Figure 10. Types of Peaks

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Next, the program decides which of two peak height determination algorithms to use. The peak heights of "up and over" peaks (such as those shown in Figures 10A and 10B) are determined by one algorithm, while the heights of all other peaks (such as those shown in Figures 10C and 10D) are determined by the second algorithm. The program distinguishes between the two classes of peaks by checking whether the top of the peak is concave downward. Mathematically, this is done by checking whether the smoothed value of the highest level reading is higher than the smoothed values at both of the endpoints of the data acquisition window. The third and fifty-eighth readings are used as the endpoints of the window because they are the first and last readings for which smoothed values can be determined.

If the peak being dealt with is an "up and over" peak, it satisfies the condition of being higher at its highest level reading than it is at either endpoint. Its peak height is taken to be the smoothed value of the highest level reading.

For peaks which do not go "up and over," the highest level reading is not always the best indication of peak height. For example, in Figure 10C, the highest level reading would be found before the plateau, at the first reading which satisfies the definition of "level," while the best place to measure the peak height would be on the plateau. Therefore, if the peak being dealt with is not an "up and over" peak, the program determines the peak height simply by examining the data at the expected position of the most valid reading. The expected position has been predicted using an algorithm described in the next section. If the expected position of the most valid reading is not level, the program does not attempt to determine the peak height. If the expected position is level, the peak height is taken to be the smoothed value of the reading at the expected position.

TIMING SYNCHRONIZATION

Timing synchronization involves keeping the data acquisition windows centered on the peaks and predicting the expected positions of the most valid readings. The timing synchronization algorithms used in the Continuous Flow Analyzer Automation System are all based on a philosophy of "when in doubt, do not change the timing parameters." Connectors A and B show how the peak height determination algorithms in Figure 11 are linked to the timing synchronization algorithms in Figure 12.

If the height of a peak is not determined by the highest level reading algorithm, that peak has no effect on the timing parameters. That is, the data acquisition window is not adjusted, and the prediction for the expected position of the most valid reading in the next peak remains the same.

If the highest level reading algorithm has been applied, the peak may influence the data acquisition window position, but only if it satisfies all four of the following conditions: 1) The height of the peak must be within the range of the heights of the non-zero calibration standards. It would be pointless to make a window adjustment based on a peak of atypical height. 2) The top of the peak must be concave downward enough that the highest

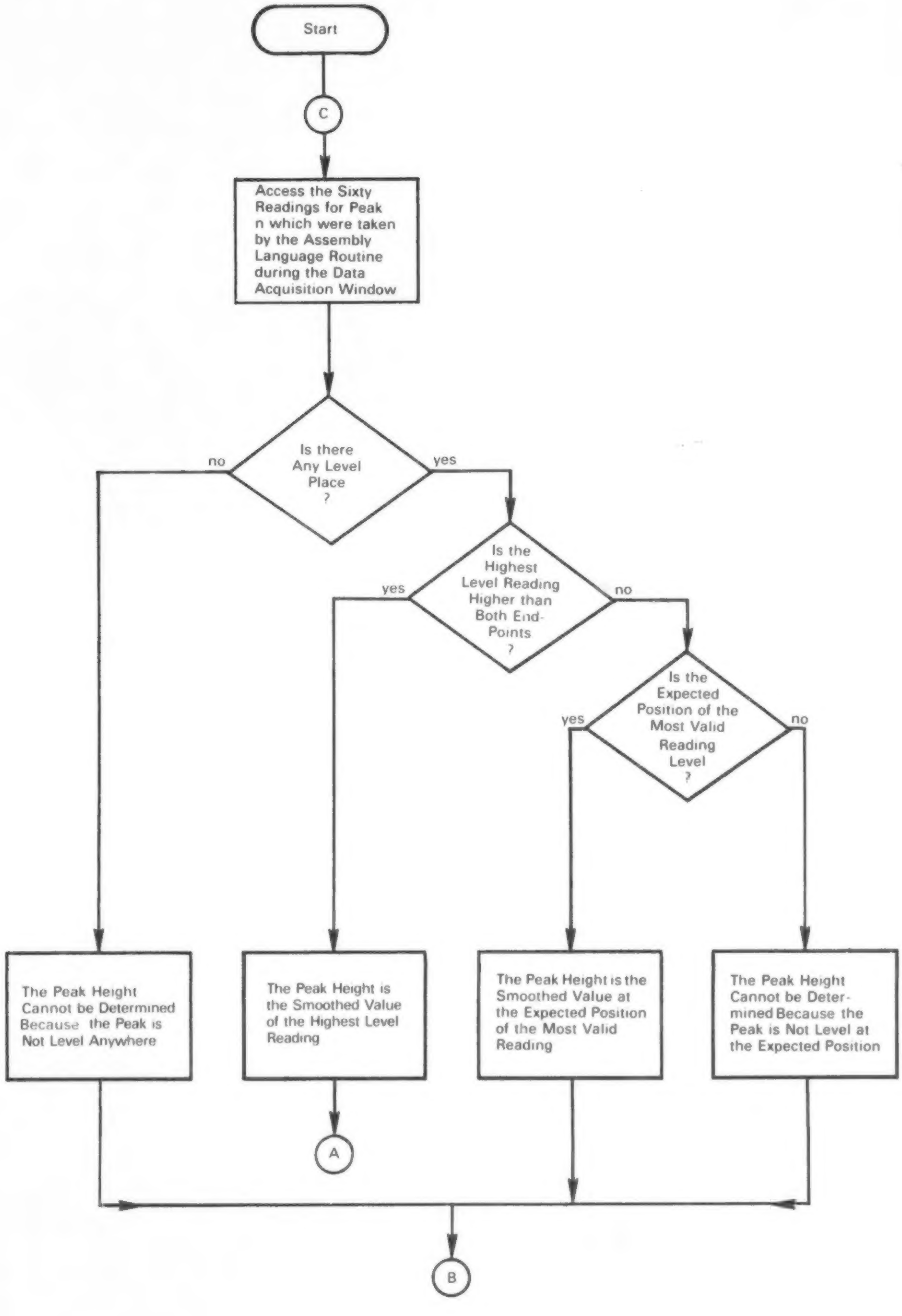
Start
C
Access the Sixty Readings for Peak n which were taken by the Assembly Language Routine during the Data Acquisition Window
Is there Any Level Place ?
no
yes
Is the Highest Level Reading Higher than Both End-Points ?
yes
no
Is the Expected Position of the Most Valid Reading Level ?
yes
no
The Peak Height Cannot be Determined Because the Peak is Not Level Anywhere
The Peak Height is the Smoothed Value of the Highest Level Reading
The Peak Height is the Smoothed Value at the Expected Position of the Most Valid Reading
The Peak Height Cannot be Determined Because the Peak is Not Level at the Expected Position
A
B

Figure 11. Peak height determination algorithms.

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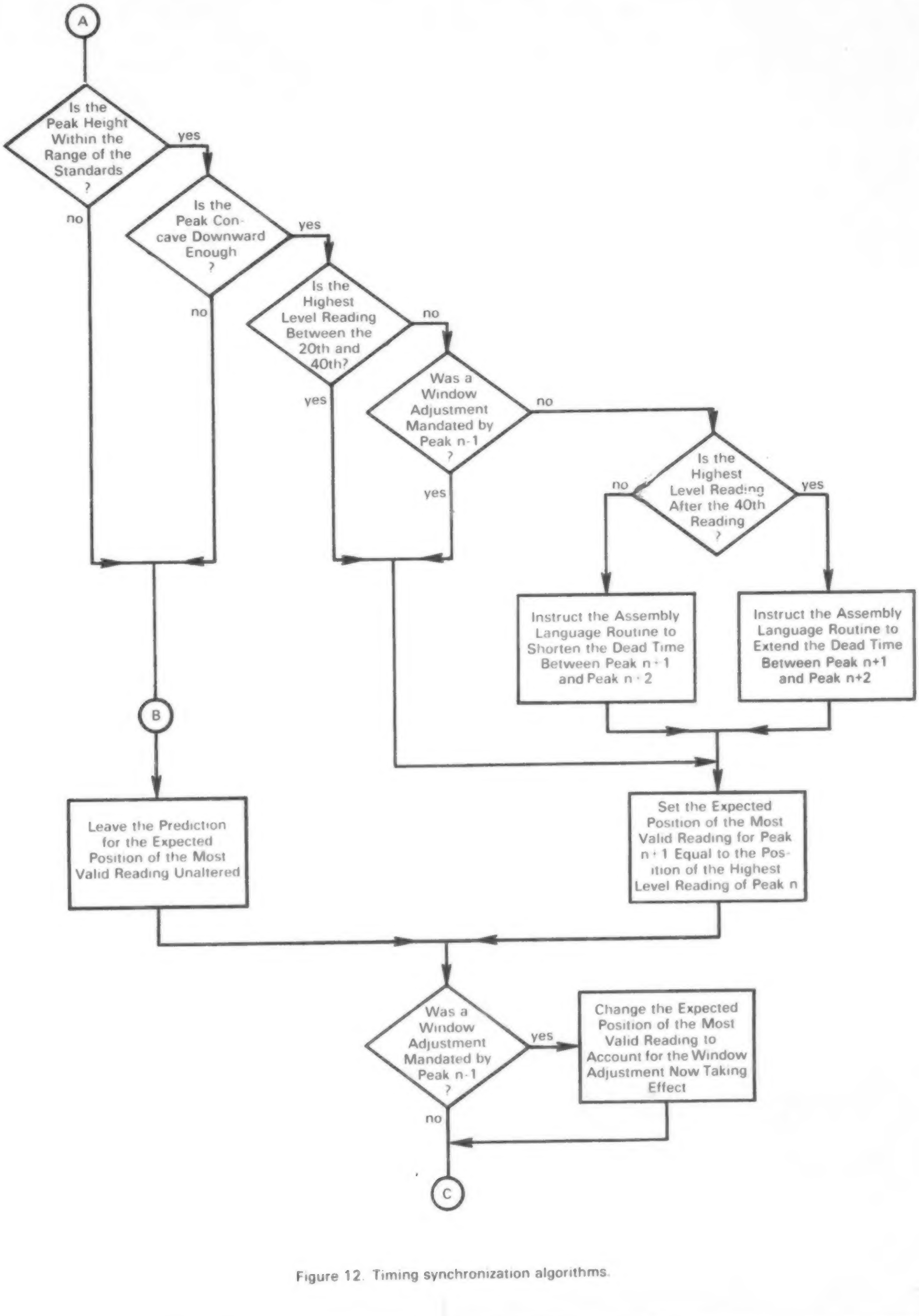
A
Is the Peak Height Within the Range of the Standards ?
yes
no
Is the Peak Concave Downward Enough ?
yes
no
Is the Highest Level Reading Between the 20th and 40th?
no
yes
Was a Window Adjustment Mandated by Peak n-1 ?
no
yes
Is the Highest Level Reading After the 40th Reading ?
no
yes
Instruct the Assembly Language Routine to Shorten the Dead Time Between Peak n+1 and Peak n+2
Instruct the Assembly Language Routine to Extend the Dead Time Between Peak n+1 and Peak n+2
B
Leave the Prediction for the Expected Position of the Most Valid Reading Unaltered
Set the Expected Position of the Most Valid Reading for Peak n+1 Equal to the Position of the Highest Level Reading of Peak n
Was a Window Adjustment Mandated by Peak n-1 ?
yes
Change the Expected Position of the Most Valid Reading to Account for the Window Adjustment Now Taking Effect
no
C

Figure 12. Timing synchronization algorithms.

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level reading is at least two times the allowable standard deviation for levelness above the average height of the endpoints. This restriction prevents a peak such as that shown in Figure 10E from causing a window adjustment. 3) The highest level reading must be either before the twentieth reading or after the fortieth reading. As long as the highest level reading is in the central third of the data acquisition window, it is considered safely centered. 4) The peak must not be the one immediately following a peak which mandated a window adjustment. If peak number n mandates a window adjustment, CFA08 issues a CALL 19 to the assembly language routine to shorten or lengthen the dead time between two peaks when it next begins a dead time period. However, the dead time between peak n and peak n+1 is already in progress. Therefore, the assembly language routine does not implement the window adjustment until the dead time between peak n+1 and peak n+2. Consequently, a window adjustment mandated by peak n will not take effect until peak n+2. Thus, peak n+1 cannot be permitted to mandate another window adjustment.

If a peak satisfies all of these conditions, a window adjustment is made. If the highest level reading is earlier in the window than the twentieth reading, the dead time between peaks n+1 and n+2 is shortened. The amount of time by which it is shortened is enough so that if peak n+2 is identical to peak n, its highest level reading will occur either ten readings later or at the twentieth reading, whichever involves the least change. Similarly, if the highest level reading is later than the fortieth reading, the dead time between peaks n+1 and n+2 is lengthened enough to cause the highest level reading of peak n+2 to be either ten readings earlier or at the fortieth reading, whichever involves the least change. The dead time reverts to its normal length between peaks n+2 and n+3 and thereafter.

Next, the program predicts the expected position of the most valid reading. To influence this prediction, an "up and over" peak must satisfy only the first two of the four conditions above. The prediction is based on the assumption that, for an "up and over" peak, the highest level reading corresponds to the time when the sample passing through the colorimeter is least diluted by wash solution and least contaminated by other samples. Assuming that the automatic sampler aspirates samples at regular intervals, the expected position of the most valid reading for the next peak is set equal to the position of the highest level reading of the current peak.

The program makes one final check regarding the expected position of the most valid reading. If a window adjustment was mandated by the previous peak, the program alters the expected position to account for the fact that the window adjustment will go into effect on the next peak. This final check is done regardless of the shape of the current peak.

The program then instructs the assembly language routine to provide the sixty readings for the next peak.

FURTHER DATA REDUCTION

The CALL 18 returns data to CFA08 as soon as it can, even if it does not have data for all of the channels. Similarly, CFA08 determines the peak heights, writes the raw data into file CFA005, and writes the peak height into CFA003 as soon as it receives the raw data. When file CFA003 has the peak heights for all of the channels for a next peak, CFA08 branches to one of ten different procedures, depending on the sample type.

For a timing set standard, the program simply displays the peak height. The peak height of the first timing set standard is given as "OK" rather than as a numerical value, since the assembly language routine often supplies irrelevant data for the first peak, even though it is functioning correctly otherwise.

For a calibration standard, the program calculates and displays the baseline-corrected peak height, and it displays the theoretical concentration of the standard. If the standard is the last standard, the program also performs several other functions. First it finds the peak heights of the highest and lowest non-zero standards. (Any subsequent sample which has a peak height out of this range is not allowed to mandate a timing adjustment.) Secondly, the program stores six arrays of automation parameters and the number of the current peak in file CFA004, and chains to program CFA09 where calibration is performed. Program CFA09 chains back to CFA08, and control is returned to this point in the program, as described previously. Then all of the automation parameters including the calibration equations are read from CFA004, and the standards are put in order for use in linear interpolation.

For an unknown, the program calculates and/or displays the dilution factor, the sample ID number, and the measured concentration. Measured concentrations below the detection limit are reported as "BDL," and offscale concentrations are reported as "OFFSCALE." If an offscale measurement occurs in an attended run, the program instructs the user to dilute the sample and move it to a position at the end of the batch for remeasurement. If the user specified a fixed additional dilution factor, the program uses that value. If the user specified a variable dilution factor, the program prescribes a dilution factor derived from the formula

$$\text{Additional dilution factor} = \text{INT}\left(\frac{\text{Estimated concentration}}{\text{Half of the offscale concentration}}\right)$$

Furthermore, if there is a peak for which the peak height cannot be determined, the program instructs the user to move it to a position at the end of the batch without diluting it. A complication to this procedure is necessary for peaks in an attended run which are offscale and for which the peak height cannot be determined. If the height of a peak cannot be determined, and at least two of the readings for the peak are higher than the highest calibration standard, the program instructs the user to dilute the sample. If the user has allowed the program to prescribe dilution factors, the program will use 1.5 times the offscale concentration as the estimated concentration when it calculates the dilution factor for a sample of this type.

Whenever a sample is repositioned, the program concatenates a percent sign to the superstring of the parameter-method codes. Then if the user attempts to use the restart option, CFA07 will see this flag and force the user to go back and re-assimilate the run file rather than trying to un-do all of the repositionings in file CFA003.

For a spiked sample, the program calculates and/or displays the wheel position of the associated sample, the dilution factor, the baseline-corrected peak height, the final concentration (LSF), the expected increase (LSA), the percent recovery, and the quality control status.

For a duplicate, the program calculates and/or displays the wheel position of the associated unknown, the dilution factor, the baseline-corrected peak height, the concentration of the duplicate (LD2), the range (RNG), and the quality control status.

For a laboratory control standard, the program calculates and/or displays the baseline-corrected peak height, the measured concentration (LCM), the theoretical concentration (LCT), the percent recovery, and the quality control status.

For a reagent blank, the program calculates and displays the baseline-corrected peak height and the measured concentration.

For an instrument check standard, the program calculates and/or displays the wheel position of the associated calibration standard, the baseline-corrected peak height, the percent recovery, and the status of the check standard with regard to the allowable error.

For a blank, the program displays the peak height and updates the baseline height. Figure 13 shows the procedure for updating the baseline.

For a remeasurement position, the program uses a dilution factor of 1, and it calculates and displays the baseline-corrected peak height and the concentration.

After the last sample has been processed, the program issues a CALL 17 to stop the assembly language routine and chains to CFA10.

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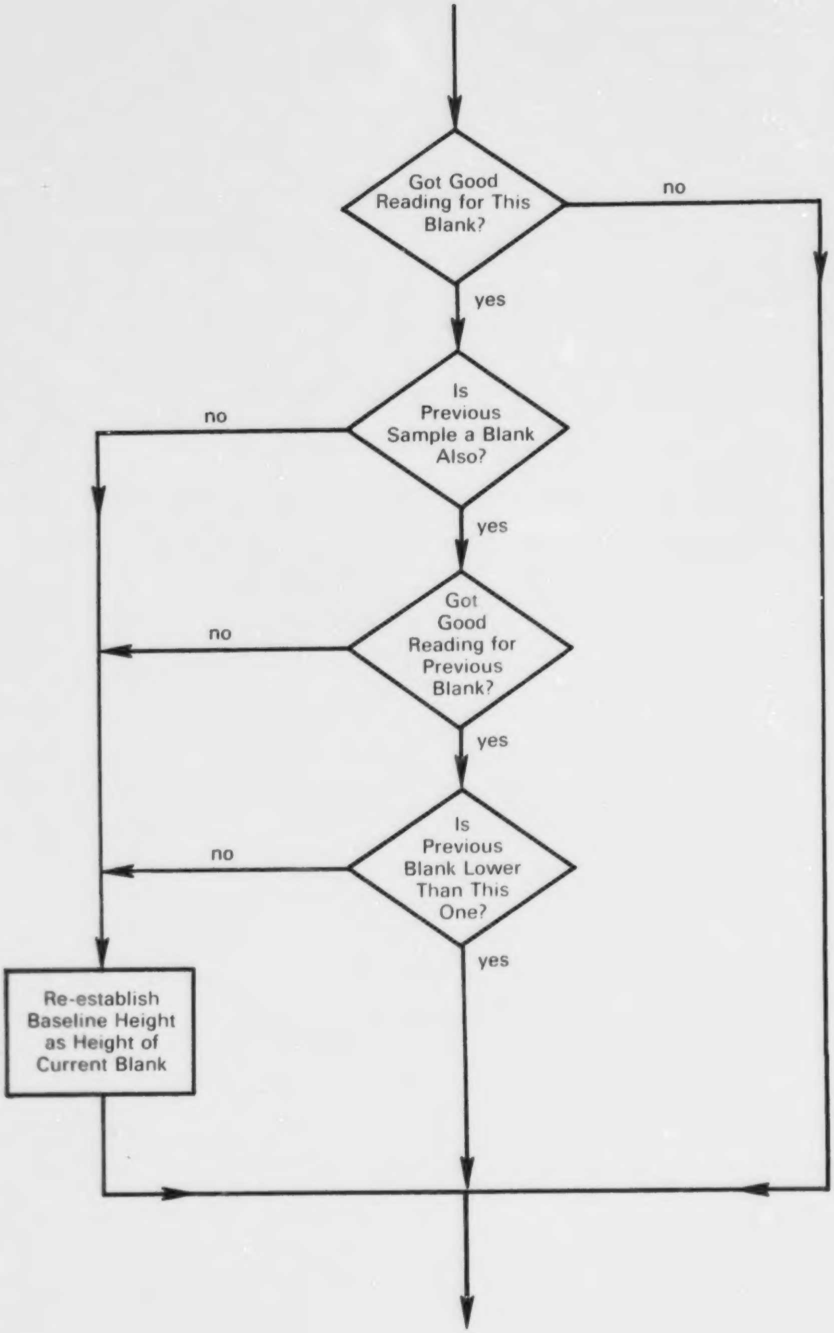
Got Good Reading for This Blank?
no
yes
Is Previous Sample a Blank Also?
no
yes
Got Good Reading for Previous Blank?
no
yes
Is Previous Blank Lower Than This One?
no
yes
Re-establish Baseline Height as Height of Current Blank

Figure 13. Baseline Height Procedures.

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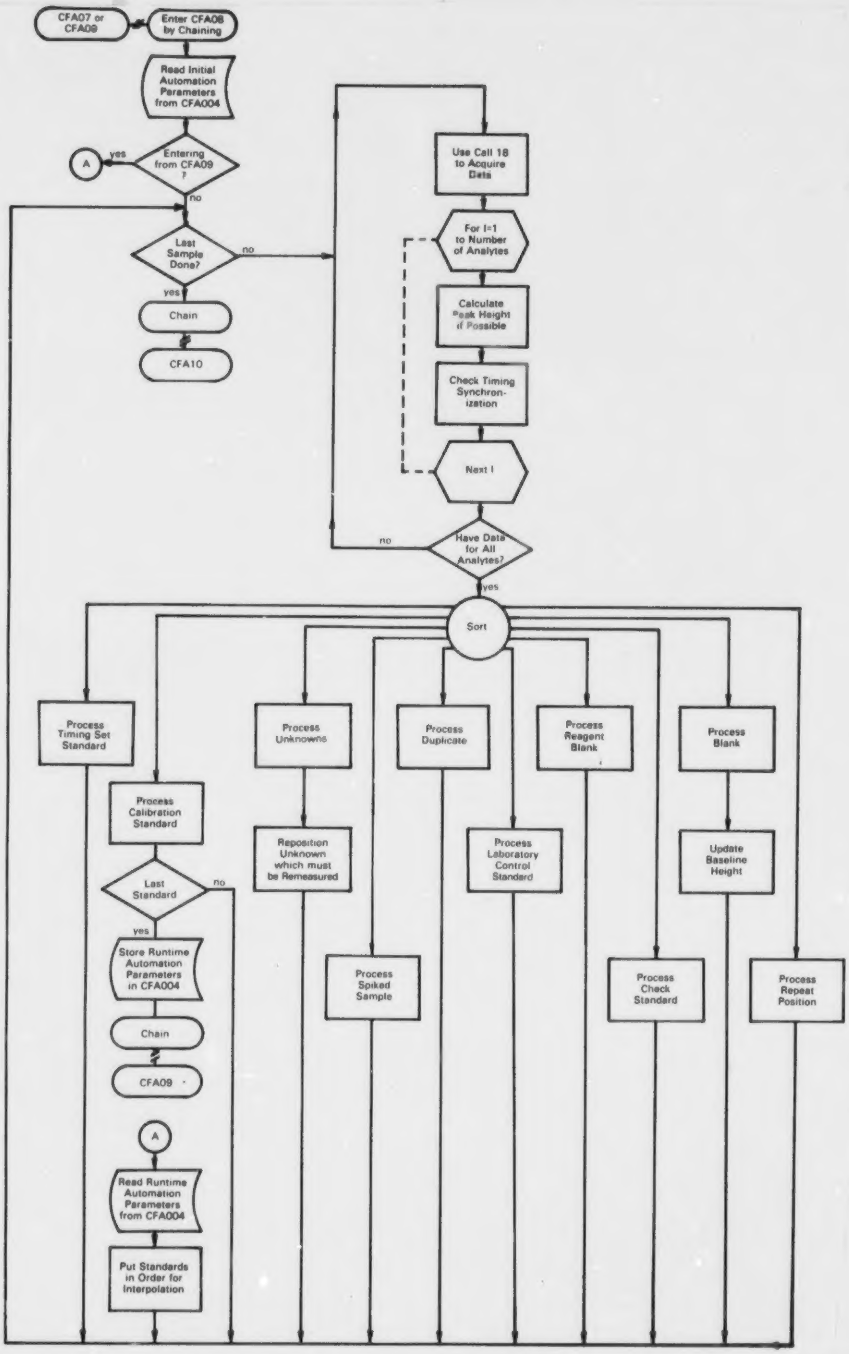
CFA07 or CFA09
Enter CFA08 by Chaining
Read Initial Automation Parameters from CFA004
A
yes
Entering from CFA09 ?
no
Last Sample Done?
no
yes
Chain
CFA10
Use Call 18 to Acquire Data
For I=1 to Number of Analytes
Calculate Peak Height if Possible
Check Timing Synchron-ization
Next I
no
Have Data for All Analytes?
yes
Sort
Process Timing Set Standard
Process Calibration Standard
Last Standard
no
yes
Store Runtime Automation Parameters in CFA004
Chain
CFA09
A
Read Runtime Automation Parameters from CFA004
Put Standards in Order for Interpolation
Process Unknowns
Reposition Unknown which must be Remeasured
Process Spiked Sample
Process Duplicate
Process Laboratory Control Standard
Process Reagent Blank
Process Check Standard
Process Blank
Update Baseline Height
Process Repeat Position

Figure 14. Functional flowchart of Program CFA08.

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TABLE 9. SYMBOL DEFINITIONS FOR CFA08

A2$	the superstring of parameter-method codes
A3$	a general purpose string of formatted data
A7	the attended run flag, where 0 indicates that the run is unattended, and 1 indicates that the run is attended
A9()	for spikes, the array of LSA values; for duplicates, the array of flags for quality control status, where 0 indicates out of control, and 1 indicates in control
B7()	the array of analogue to digital converter counts at full scale
B8()	the array of analogue to digital converter counts at proper damping
B()	the array of current baseline heights expressed in percent of full scale
C()	the array of data common to all analytes for a wheel position; see symbol definitions for CFA03
D	the additional dilution factor for offscale samples, or a zero to indicate that the additional dilution factor is to be calculated by the program
D2	the dilution factor
D2()	the array of sixty readings for a peak expressed in percent of full scale
D8	the calculated or prescribed additional dilution factor for offscale samples
D()	the array of readings for a peak in analogue to digital converter counts returned by CALL 18
E()	the array of peak numbers returned by CALL 18
F5	the smoothed value for the third reading for a peak
G2	the standard deviation of five consecutive readings
G7()	the array of lowest peak heights which may effect the timing synchronization
G8()	the array of the highest peak heights which may effect the timing synchronization
G9()	the array of allowable standard deviations defining levelness
H8	the peak height of the expected position of the most valid reading
H9	the peak height at the highest level position
I	the control variable for loops
I3()	the array of allowable errors for check standards
I5()	the array of standards data used to calculate concentrations by linear interpolation
I6()	the array of the coefficients of the calibration equations
J	the control variable for loops
K	the control variable for loops
K5()	the array of degrees of least squares regression
L5	the smoothed value for the 58th reading for a peak
L()	the array of peak numbers for the last peaks to mandate timing synchronization adjustments
M	the mean height of five consecutive readings for a peak
M7	the number of calibration standards
M()	the array of the coefficients of the calibration equation for one analyte

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(4-76)

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N	the number of analytes
O0	a wheel position number passed to a subroutine to be formatted
P	the number of the current peak
P7	the expected position of the most valid reading
P8()	the array of the expected positions of the most valid readings of the next peaks
P9	the position of the highest level reading
Q0	the sample type code
Q5	the volume of the original sample
Q6	the volume of the dilution water
Q7	the wheel position of the associated unknown
R0	the sum of the squares of the differences from the mean
R9$	the name of the run file
R9()	for spikes and laboratory control standards, the array of percent recoveries; for duplicates, the array of ranges; for reagent blanks, the array of calculated concentrations
S$	the sample ID number
S2()	the array of data specific to all of the analytes
S3()	the array of data specific to one analyte for the previous sample
S8()	the array of the amounts of timing shift
S()	the data specific to one analyte for a wheel position; see symbol definitions for CFA03
U5()	the array of analogue to digital converter channel numbers
U6()	the array of data acquisition window widths
V	the smoothed value for a reading
V8	the number of readings for a noisy peak which are higher than the highest calibration standard
W	the number of wheel positions occupied by the entire batch
W2	the number of positions in one sample wheel
W5()	the array of detection limits
W6()	the array of offscale concentrations
W8	a flag where zero indicates that no analyte exceeded the quality control warning limit, and any other number indicates that at least one analyte did
W9	a flag where zero indicates that no analyte exceeded the quality control limit, and any other number indicates that at least one analyte did
X1	the peak height of the standard below a sample
X2	the peak height of the standard above a sample
Y	the algorithm applied
Y1	the concentration of the standard below a sample
Y2	the concentration of the standard above a sample
Z	the amount of timing shift
Z3	a holding variable used in sorting
Z4	a holding variable used in sorting
Z()	the array of data acquisition window adjustment information passed to CALL 19

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C-O-N-T-I-N-U-O-U-S   F-L-O-W   A-N-A-L-Y-Z-E-R   A-U-T-O   S-Y-S-T-E-M
5/23/1980                                                       PAGE  1
                       PROGRAM LISTING FOR CFA08

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
0010 REM   +=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+
0020 REM   +   CONTINUOUS FLOW ANALYZER AUTOMATION SYSTEM              +
0030 REM   +   PROGRAM CFA08, DATA ACQUIRER AND REDUCER                +
0040 REM   +   BY:  J. KOPKE (UCCC)     FEBRUARY 19, 1980              +
0050 REM   +   MOST RECENT REVISION:  APRIL 15, 1980                   +
0060 REM   +=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+
0070 REM
0080 ON ESC THEN GOTO 0110
0090 ESC
0100 GOTO 0160
0110 NOESC
0120 CALL 17
0130 WRITE FILE[4,0],N,A2$,R9$,W,W2,0
0140 CLOSE
0150 CHAIN "CFA00"
0160 DIM A2$[22],R9$[13],S[14],C[4],S$[8],D2[60]
0170 DIM Z[2]
0180 DIM A3$[79],S3[14],M[4]
0190 READ FILE[4,0],N,A2$,R9$,W,W2
0200 DIM E[N],D[N*60],B7[N],B8[N],G7[N],G9[N],P8[N],L[N],S8[N]
0210 DIM I5[2*N,20]
0220 DIM U5[N],U6[N],S2[N,14],B[N],G8[N],I6[N,4],K5[N],W5[N],W6[N]
0230 DIM A9[N],R9[N],I3[N]
0240 MAT D=ZER
0250 MAT READ FILE[5,4],U5
0260 MAT READ FILE[5,6],U6
0270 MAT READ FILE[5,7],G9
0280 MAT READ FILE[5,12],B7
0290 MAT READ FILE[5,13],B8
0300 ON ERR THEN GOTO 0320
0310 RENAME "CFA006","CFA006"
0320 ON ERR THEN STOP
0330 IF SYS(7)<>-10 THEN GOTO 1900
0340 FOR I=1 TO N
0350   LET G8[I]=100
0360   LET G7[I]=10
0370   LET P8[I]=30
0380   LET L[I]=0
0390   LET B[I]=0
0400 NEXT I
0410 LET P=0
0420 ON ERR THEN GOTO 0440

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
```

```
C-O-N-T-I-N-U-O-U-S   F-L-O-W   A-N-A-L-Y-Z-E-R   A-U-T-O   S-Y-S-T-E-M
5/23/1980                                                       PAGE  2
                       PROGRAM LISTING FOR CFA08

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
0430 DELETE "CFA005"
0440 ON ERR THEN STOP
0450 OPEN FILE[6,0],"CFA005",240
0460 WRITE FILE[6,0],N,A2$,0
0470 REM   ________________________________________________________________
0480 REM              ACQUIRE DATA AND CALCULATE PEAK HEIGHT
0490 LET P=P+1
0500 IF P>W THEN GOTO 5080
0510 MAT E=ZER
0520 CALL 18,E[1],D[1]
0530 FOR K=1 TO N
0540   LET Y=-99999
0550   LET Z=-99999
0560   IF E[K]=0 THEN GOTO 1320
0570   IF E[K]>0 THEN GOTO 0630
0580   PRINT "<7>           <7>           <7>           <7>           <7>"
0590   PRINT "    THIS SYSTEM IS SO FAR BEHIND THE AUTOMATIC SAMPLER
*    THAT IT IS"
0600   PRINT "    IMPOSSIBLE TO CATCH UP;  THE AUTOMATED RUN IS BEING
*     TERMINATED"
0610   PRINT
0620   GOTO 0110
0630   FOR I=1 TO 60
0640     LET D2[I]=100*(D[(K-1)*60+I]-B8[K])/(B7[K]-B8[K])
0650   NEXT I
0660   LET H8=-99999
0670   LET H9=-99999
0680   FOR I=3 TO 58
0690     LET V=(D2[I-2]*(-3)+D2[I-1]*12+D2[I]*17+D2[I+1]*12+D2[I+2]*(-
*    3))/35
0700     IF I=3 THEN LET F5=V
0710     IF I=58 THEN LET L5=V
0720     LET M=(D2[I-2]+D2[I-1]+D2[I]+D2[I+1]+D2[I+2])/5
0730     LET R0=0
0740     FOR J=-2 TO 2
0750       LET R0=R0+(D2[I+J]-M)^2
0760     NEXT J
0770     LET G2=SQR(R0/4)
0780     IF G2>G9[K] THEN GOTO 0830
0790     IF I=P8[K] THEN LET H8=V
0800     IF H9>V THEN GOTO 0830
0810     LET H9=V

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
```

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```
C-O-N-T-I-N-U-O-U-S  F-L-O-W  A-N-A-L-Y-Z-E-R  A-U-T-O  S-Y-S-T-E-M
5/23/1980                                                     PAGE  3
                    PROGRAM LISTING FOR CFA08

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
0820      LET P9=I
0830    NEXT I
0840    MAT READ FILE[4,(E[K]-1)*(N+1)+1+K],S
0850    LET P7=P8[K]
0860    REM           PEAK WITH NO LEVEL POSITION
0870    IF H9<>-99999 THEN GOTO 0910
0880    LET S[1]=-88888
0890    GOTO 0940
0900    REM           NON-UP-AND-OVER PEAK
0910    IF F5<H9 THEN IF L5<H9 THEN GOTO 1040
0920    IF H8<>-99999 THEN GOTO 1000
0930    LET S[1]=-77777
0940    LET V8=0
0950    FOR I=1 TO 60
0960      IF D2[I]>G8[K] THEN LET V8=V8+1
0970    NEXT I
0980    IF V8>=2 THEN LET S[1]=-87878
0990    GOTO 1250
1000    LET S[1]=H8
1010    LET Y=1
1020    GOTO 1250
1030    REM           UP-AND-OVER PEAK
1040    LET S[1]=H9
1050    LET Y=2
1060    REM    ------------------------------------------------------------
1070    REM           PERFORM WINDOW ADJUSTMENT
1080    IF P=1 THEN GOTO 1290
1090    IF H9>G8[K] THEN GOTO 1250
1100    IF H9<G7[K] THEN GOTO 1250
1110    IF H9<2*G9[K]+(F5+L5)/2 THEN GOTO 1250
1120    IF P9>=20 THEN IF P9<=40 THEN GOTO 1240
1130    IF L[K]=E[K]-1 THEN GOTO 1240
1140    IF P9>30 THEN GOTO 1180
1150    LET S8[K]=P9-20
1160    IF S8[K]<-10 THEN LET S8[K]=-10
1170    GOTO 1200
1180    LET S8[K]=P9-40
1190    IF S8[K]>10 THEN LET S8[K]=10
1200    LET Z[2]=S8[K]*U6[K]/8
1210    LET Z=Z[2]*2/15
1220    LET Z[1]=U5[K]
1230    CALL 19,Z[1]

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
```

```
C-O-N-T-I-N-U-O-U-S  F-L-O-W  A-N-A-L-Y-Z-E-R  A-U-T-O  S-Y-S-T-E-M
5/23/1980                                                     PAGE  4
                    PROGRAM LISTING FOR CFA08

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
1240    LET P8[K]=P9
1250    IF L[K]=E[K]-1 THEN LET P8[K]=P8[K]-S8[K]
1260    IF Z<>-99999 THEN LET L[K]=E[K]
1270    REM    ------------------------------------------------------------
1280    REM           STORE DATA
1290    WRITE FILE[6,(E[K]-1)*2*N+2*(K-1)+1],H8,H9,P9,P7,Y,Z
1300    MAT WRITE FILE[6,(E[K]-1)*2*N+2*(K-1)+2],D2
1310    MAT WRITE FILE[4,(E[K]-1)*(N+1)+1+K],S
1320 NEXT K
1330 REM    --------------------------------------------------------------
1340 REM           SORT
1350 FOR I=1 TO N
1360    MAT READ FILE[4,(P-1)*(N+1)+I+1],S
1370     IF S[1]=-99999 THEN GOTO 0510
1380 NEXT I
1390 WRITE FILE[6,0],N,A2$,P
1400 LET O0=P
1410 GOSUB 5800
1420 LET A3$=A3$,"  "
1430 READ FILE[4,(P-1)*(N+1)+1],C[1],C[2],C[3],C[4],S$
1440 ON C[1] THEN GOTO 1470, 1530, 2330, 3050, 3530, 4100, 4370, 4510,
*      4780, 4980, 2330
1450 REM    --------------------------------------------------------------
1460 REM           TIMING SET STANDARD
1470 LET A3$=A3$,"SET STANDARD              PH:"
1480 PRINT A3$;
1490 GOSUB 5180
1500 GOTO 0490
1510 REM    --------------------------------------------------------------
1520 REM           CALIBRATION STANDARD
1530 LET A3$=A3$,"CAL STANDARD            BCPH:"
1540 PRINT A3$;
1550 GOSUB 5180
1560 PRINT "                                    TCONC:";
1570 FOR I=1 TO N
1580    PRINT USING "-----#.### ",S2[I,13];
1590 NEXT I
1600 PRINT
1610 GOSUB 5360
1620 FOR I=1 TO N
1630    IF S2[I,1]>-1000 THEN GOTO 1690
1640    PRINT "<7>          <7>          <7>          <7>          <7>"

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
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```
C-O-N-T-I-N-U-O-U-S   F-L-O-W   A-N-A-L-Y-Z-E-R   A-U-T-O   S-Y-S-T-E-M
5/23/1980                                                          PAGE  5
                        PROGRAM LISTING FOR CFA08

12345678911234567892123456789312345678941234567895123456789612345678 97
         0         0         0         0         0         0         0
 1650   PRINT "     A CALIBRATION STANDARD HAS BEEN MISSED;  THE AUTOMA
*  TED RUN"
 1660   PRINT "     IS BEING TERMINATED"
 1670   PRINT
 1680   GOTO 0110
 1690 NEXT I
 1700 READ FILE[4,P*(N+1)+1],C[1]
 1710 IF C[1]=2 THEN GOTO 0490
 1720 FOR I=1 TO N
 1730   LET G8[I]=-100
 1740   LET G7[I]=200
 1750   FOR J=6 TO P
 1760     MAT READ FILE[4,(J-1)*(N+1)+1+I],S
 1770     IF S[1]>G8[I] THEN LET G8[I]=S[1]
 1780     IF S[1]<G7[I] THEN IF S[13]>0 THEN LET G7[I]=S[1]
 1790   NEXT J
 1800 NEXT I
 1810 MAT WRITE FILE[5,15],B
 1820 MAT WRITE FILE[5,16],G7
 1830 MAT WRITE FILE[5,17],G8
 1840 MAT WRITE FILE[5,18],L
 1850 MAT WRITE FILE[5,19],P8
 1860 MAT WRITE FILE[5,20],S8
 1870 WRITE FILE[5,21],P
 1880 NOESC
 1890 CHAIN "CFA09"
 1900 READ FILE[5,3],D
 1910 MAT READ FILE[5,8],K5
 1920 MAT READ FILE[5,9],W5
 1930 MAT READ FILE[5,10],W6
 1940 MAT READ FILE[5,11],I3
 1950 READ FILE[5,14],A7
 1960 MAT READ FILE[5,15],B
 1970 MAT READ FILE[5,16],G7
 1980 MAT READ FILE[5,17],G8
 1990 MAT READ FILE[5,18],L
 2000 MAT READ FILE[5,19],P8
 2010 MAT READ FILE[5,20],S8
 2020 READ FILE[5,21],P
 2030 FOR I=1 TO N
 2040   MAT READ FILE[5,24+I],M
 2050   FOR J=1 TO 4

12345678911234567892123456789312345678941234567895123456789612345678 97
         0         0         0         0         0         0         0
```

```
C-O-N-T-I-N-U-O-U-S   F-L-O-W   A-N-A-L-Y-Z-E-R   A-U-T-O   S-Y-S-T-E-M
5/23/1980                                                          PAGE  6
                        PROGRAM LISTING FOR CFA08

12345678911234567892123456789312345678941234567895123456789612345678 97
         0         0         0         0         0         0         0
2060     LET I6[I,J]=M[J]
2070   NEXT J
2080 NEXT I
2090 LET M7=P-5
2100 FOR I=6 TO P
2110   FOR J=1 TO N
2120     MAT READ FILE[4,(I-1)*(N+1)+1+J],S
2130     LET I5[2*J-1,I-5]=S[2]
2140     LET I5[2*J,I-5]=S[13]
2150   NEXT J
2160 NEXT I
2170 FOR I=1 TO N
2180   FOR J=M7 TO 2 STEP -1
2190     FOR K=2 TO J
2200       IF I5[2*I-1,K-1]<=I5[2*I-1,K] THEN GOTO 2270
2210       LET Z3=I5[2*I-1,K]
2220       LET Z4=I5[2*I,K]
2230       LET I5[2*I-1,K]=I5[2*I-1,K-1]
2240       LET I5[2*I,K]=I5[2*I,K-1]
2250       LET I5[2*I-1,K-1]=Z3
2260       LET I5[2*I,K-1]=Z4
2270     NEXT K
2280   NEXT J
2290 NEXT I
2300 GOTO 0490
2310 REM   ----------------------------------------------------------
2320 REM          UNKNOWN
2330 LET D2=(C[2]+C[3])/C[2]
2340 IF C[1]<>11 THEN GOTO 2390
2350 LET A3$=A3$,"REPEAT OF 000 ####.##  BCPH:"
2360 LET A3$[27-LEN(STR$(C[4])),26]=STR$(C[4])
2370 PRINT USING A3$,D2;
2380 GOTO 2410
2390 LET A3$=A3$,"ID: ########  ####.##  BCPH:"
2400 PRINT USING A3$,S$,D2;
2410 GOSUB 5180
2420 PRINT "                                   CONC:";
2430 GOSUB 5450
2440 GOSUB 5360
2450 IF A7=0 THEN GOTO 0490
2460 IF C[1]=11 THEN GOTO 0490
2470 FOR I=1 TO N

12345678911234567892123456789312345678941234567895123456789612345678 97
         0         0         0         0         0         0         0
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AND ILLUSTRATIONS
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```
C-O-N-T-I-N-U-O-U-S   F-L-O-W   A-N-A-L-Y-Z-E-R   A-U-T-O   S-Y-S-T-E-M
5/23/1980                                                         PAGE  7
                       PROGRAM LISTING FOR CFA08

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
2480    IF S2[I,12]>=W6[I] THEN GOTO 2590
2490 NEXT I
2500 FOR I=1 TO N
2510    IF S2[I,1]<>-87878 THEN GOTO 2540
2520    LET S2[I,12]=W6[I]*1.5
2530    GOTO 2590
2540 NEXT I
2550 FOR I=1 TO N
2560    IF S2[I,1]<=-1000 THEN GOTO 2680
2570 NEXT I
2580 GOTO 0490
2590 WRITE FILE[4,(P-1)*(N+1)+1],C[1],C[2],C[3],W-1,S$
2600 IF D=0 THEN GOTO 2630
2610 LET D8=D
2620 GOTO 2640
2630 LET D8=INT(S2[I,12]/(.5*W6[I]))
2640 LET C[3]=C[3]+(D8-1)*(C[2]+C[3])
2650 PRINT "<7>              <7>             <7>             <7>"
2660 PRINT USING "      DILUTE BY FACTOR OF ####.## FOR TOTAL DILUTION
*     OF ####.##;",D8,(C[2]+C[3])/C[2]
2670 GOTO 2710
2680 WRITE FILE[4,(P-1)*(N+1)+1],C[1],C[2],C[3],W-1,S$
2690 PRINT "<7>              <7>             <7>             <7>"
2700 PRINT "      DO NOT DILUTE;"
2710 LET O0=W-1
2720 GOSUB 5800
2730 PRINT "      MOVE BLANK FROM WHEEL POSITION ";A3$;
2740 LET O0=W+1
2750 GOSUB 5800
2760 PRINT " TO ";A3$;";"
2770 PRINT USING "      PLACE SAMPLE ######## ",S$;
2780 LET O0=W-1
2790 GOSUB 5800
2800 PRINT "IN WHEEL POSITION ";A3$
2810 PRINT
2820 LET C[1]=11
2830 LET C[4]=P
2840 WRITE FILE[4,(W-2)*(N+1)+1],C[1],C[2],C[3],C[4],S$
2850 READ FILE[4,(W-1)*(N+1)+1],C[1],C[2],C[3],C[4],S$
2860 WRITE FILE[4,(W)*(N+1)+1],C[1],C[2],C[3],C[4],S$
2870 FOR I=1 TO N
2880    MAT READ FILE[4,(W-1)*(N+1)+1+I],S

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
```

```
C-O-N-T-I-N-U-O-U-S   F-L-O-W   A-N-A-L-Y-Z-E-R   A-U-T-O   S-Y-S-T-E-M
5/23/1980                                                         PAGE  8
                       PROGRAM LISTING FOR CFA08

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
2890    MAT WRITE FILE[4,(W)*(N+1)+1+I],S
2900    MAT READ FILE[4,(W-2)*(N+1)+1+I],S
2910    MAT WRITE FILE[4,(W-1)*(N+1)+1+I],S
2920 NEXT I
2930 FOR I=1 TO N
2940    LET S[1]=-99999
2950    FOR J=2 TO 14
2960      LET S[J]=S2[I,J]
2970    NEXT J
2980    MAT WRITE FILE[4,(W-2)*(N+1)+1+I],S
2990 NEXT I
3000 LET W=W+1
3010 LET A2$=A2$,"Z"
3020 GOTO 0490
3030 REM    ------------------------------------------------------------
3040 REM             SPIKED SAMPLE
3050 LET A3$=A3$,"SPIKE OF 000  ####.##  BCPH:"
3060 LET A3$[26-LEN(STR$(C[4])),25]=STR$(C[4])
3070 LET Q5=C[2]
3080 LET Q7=C[3]
3090 LET Q6=C[4]
3100 READ FILE[4,(Q6-1)*(N+1)+1],C[1],C[2],C[3],C[4],S$
3110 PRINT USING A3$,(C[2]+C[3])/C[2];
3120 GOSUB 5180
3130 LET D2=(C[2]+C[3]+Q5)/(C[2]+Q5)
3140 PRINT "                                                  LSF:";
3150 GOSUB 5450
3160 FOR I=1 TO N
3170    MAT READ FILE[4,(Q6-1)*(N+1)+1+I],S
3180    IF Q5<>0 THEN GOTO 3210
3190    LET A9[I]=S2[I,13]/C[2]
3200    GOTO 3250
3210    IF S[1]>-1000 THEN IF S[12]>=W5[I] THEN IF S[12]<W6[I] THEN GOT
*     0 3240
3220    LET A9[I]=-99999
3230    GOTO 3250
3240    LET A9[I]=(S2[I,13]*Q5*C[2]-S[12]*C[2]*Q5-S[12]*Q5*C[3])/(C[2]*
*     C[2]+C[2]*Q5)
3250    IF S2[I,1]>-1000 THEN IF S2[I,12]>=W5[I] THEN IF S2[I,12]<W6[I]
*      THEN GOTO 3270
3260    GOTO 3280
3270    IF S[1]>-1000 THEN IF S[12]>=W5[I] THEN IF S[12]<W6[I] THEN GOT
*     0 3300

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
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C-O-N-T-I-N-U-O-U-S   F-L-O-W   A-N-A-L-Y-Z-E-R   A-U-T-O   S-Y-S-T-E-M
5/23/1980                                                          PAGE  9
                    PROGRAM LISTING FOR CFA08

  1234567891123456789212345678931234567894123456789512345678961234567897
           0         0         0         0         0         0         0
  3280   LET R9[I]=-99999
  3290   GOTO 3310
  3300   LET R9[I]=100*(S2[I,12]*D2-S[12]*(C[2]+C[3])/C[2])/A9[I]
  3310 NEXT I
  3320 PRINT "                                       LSA:";
  3330 FOR I=1 TO N
  3340   IF A9[I]<>-99999 THEN GOTO 3370
  3350   PRINT "       CBD ";
  3360   GOTO 3380
  3370   PRINT USING "-----#.### ",A9[I];
  3380 NEXT I
  3390 PRINT
  3400 PRINT "                                      RECV:";
  3410 FOR I=1 TO N
  3420   IF R9[I]<>-99999 THEN GOTO 3450
  3430   PRINT "       CBD ";
  3440   GOTO 3460
  3450   PRINT USING " ----#.##% ",R9[I];
  3460 NEXT I
  3470 PRINT
  3480 GOSUB 5870
  3490 GOSUB 5360
  3500 GOTO 0490
  3510 REM     --------------------------------------------------------
  3520 REM             DUPLICATE
  3530 LET A3$=A3$,"DUPE  OF 000  ####.##  BCPH:"
  3540 LET A3$[26-LEN(STR$(C[4])),25]=STR$(C[4])
  3550 LET Q0=C[1]
  3560 LET Q6=C[4]
  3570 READ FILE[4,(Q6-1)*(N+1)+1],C[1],C[2],C[3],C[4],S$
  3580 LET D2=(C[2]+C[3])/C[2]
  3590 PRINT USING A3$,D2;
  3600 GOSUB 5180
  3610 LET A3$="                                        LD#:"
  3620 LET A3$[40,40]=STR$((Q0-4.99999)*10)
  3630 PRINT A3$;
  3640 GOSUB 5450
  3650 FOR I=1 TO N
  3660   MAT READ FILE[4,(Q6-1)*(N+1)+1+I],S
  3670   IF S[1]>-1000 THEN IF S[12]>=W5[I] THEN IF S[12]<W6[I] THEN GOT
*        0 3690
  3680   GOTO 3700

  1234567891123456789212345678931234567894123456789512345678961234567897
           0         0         0         0         0         0         0
```

```
C-O-N-T-I-N-U-O-U-S   F-L-O-W   A-N-A-L-Y-Z-E-R   A-U-T-O   S-Y-S-T-E-M
5/23/1980                                                          PAGE 10
                    PROGRAM LISTING FOR CFA08

  1234567891123456789212345678931234567894123456789512345678961234567897
           0         0         0         0         0         0         0
  3690   IF S2[I,1]>-1000 THEN IF S2[I,12]>=W5[I] THEN IF S2[I,12]<W6[I]
*        THEN GOTO 3720
  3700   LET R9[I]=-99999
  3710   GOTO 3730
  3720   LET R9[I]=ABS(S[12]*D2-S2[I,12]*D2)
  3730   IF R9[I]<>-99999 THEN GOTO 3760
  3740   LET A9[I]=-99999
  3750   GOTO 3780
  3760   LET A9[I]=0
  3770   IF R9[I]>S[10]*((S[12]*D2+S2[I,12]*D2)/2)+S[11] THEN LET A9[I]=
*        1
  3780 NEXT I
  3790 PRINT "                                        RNG:";
  3800 FOR I=1 TO N
  3810   IF R9[I]<>-99999 THEN GOTO 3840
  3820   PRINT "       CBD ";
  3830   GOTO 3850
  3840   PRINT USING "-----#.### ",R9[I];
  3850 NEXT I
  3860 PRINT
  3870 PRINT "                                         QC:";
  3880 FOR I=1 TO N
  3890   IF A9[I]<>-99999 THEN GOTO 3920
  3900   PRINT "       CBD ";
  3910   GOTO 3960
  3920   IF A9[I]<>0 THEN GOTO 3950
  3930   PRINT "        OK ";
  3940   GOTO 3960
  3950   PRINT "   UP CONT ";
  3960 NEXT I
  3970 PRINT
  3980 FOR I=1 TO N
  3990   IF A9[I]=0 THEN GOTO 4050
  4000   IF A9[I]=-99999 THEN GOTO 4050
  4010   PRINT "<7>           <7>           <7>"
  4020   PRINT "     QC CONTROL LIMIT EXCEEDED"
  4030   PRINT
  4040   GOTO 4060
  4050 NEXT I
  4060 GOSUB 5360
  4070 GOTO 0490
  4080 REM     --------------------------------------------------------

  1234567891123456789212345678931234567894123456789512345678961234567897
           0         0         0         0         0         0         0
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EPA-287 (Cin.)
(4-76)

TYPING GUIDE SHEET

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C-O-N-T-I-N-U-O-U-S  F-L-O-W  A-N-A-L-Y-Z-E-R  A-U-T-O  S-Y-S-T-E-M
5/23/1980                                                    PAGE 11
                     PROGRAM LISTING FOR CFA08

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
4090 REM         LABORATORY CONTROL STANDARD
4100 LET A3$=A3$,"CONTROL STND               BCPH:"
4110 PRINT A3$;
4120 GOSUB 5180
4130 LET D2=1
4140 PRINT "                                        LCM:";
4150 GOSUB 5450
4160 PRINT "                                        LCT:";
4170 FOR I=1 TO N
4180   PRINT USING "-----#.### ",S2[I,13];
4190 NEXT I
4200 PRINT
4210 PRINT "                                       RECV:";
4220 FOR I=1 TO N
4230   IF S2[I,1]>-1000 THEN IF S2[I,12]>=W5[I] THEN IF S2[I,12]<W6[I]
*    THEN GOTO 4270
4240   LET R9[I]=-99999
4250   PRINT "       CBD ";
4260   GOTO 4290
4270   LET R9[I]=100*S2[I,12]/S2[I,13]
4280   PRINT USING " ----#.##% ",R9[I];
4290 NEXT I
4300 PRINT
4310 LET Q6=P
4320 GOSUB 5870
4330 GOSUB 5360
4340 GOTO 0490
4350 REM  ----------------------------------------------------------------
4360 REM         REAGENT BLANK
4370 LET A3$=A3$,"REAGENT BLNK              BCPH:"
4380 PRINT A3$;
4390 GOSUB 5180
4400 PRINT "                                       CONC:";
4410 GOSUB 5450
4420 FOR I=1 TO N
4430   LET R9[I]=S2[I,12]
4440 NEXT I
4450 LET Q6=P
4460 GOSUB 5870
4470 GOSUB 5360
4480 GOTO 0490
4490 REM  ----------------------------------------------------------------

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
```

```
C-O-N-T-I-N-U-O-U-S  F-L-O-W  A-N-A-L-Y-Z-E-R  A-U-T-O  S-Y-S-T-E-M
5/23/1980                                                    PAGE 12
                     PROGRAM LISTING FOR CFA08

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
4500 REM         CHECK STANDARD
4510 LET A3$=A3$,"CHECK OF 000              BCPH:"
4520 LET A3$[26-LEN(STR$(C[4])),25]=STR$(C[4])
4530 PRINT A3$;
4540 GOSUB 5180
4550 PRINT "                                       RECV:";
4560 FOR I=1 TO N
4570   IF S2[I,1]>-1000 THEN GOTO 4610
4580   LET R9[I]=-99999
4590   PRINT "       CBD ";
4600   GOTO 4640
4610   MAT READ FILE[4,(C[4]-1)*(N+1)+1+I],S
4620   LET R9[I]=100*S2[I,2]/S[2]
4630   PRINT USING " ----#.##% ",R9[I];
4640 NEXT I
4650 PRINT
4660 FOR I=1 TO N
4670   IF R9[I]=-99999 THEN GOTO 4730
4680   IF R9[I]>100-I3[I] THEN IF R9[I]<100+I3[I] THEN GOTO 4730
4690   PRINT "<7>           <7>           <7>"
4700   PRINT "       ALLOWABLE ERROR FOR CHECK STANDARD EXCEEDED"
4710   PRINT
4720   GOTO 4740
4730 NEXT I
4740 GOSUB 5360
4750 GOTO 0490
4760 REM  ----------------------------------------------------------------
4770 REM         BLANK
4780 LET A3$=A3$,"BLANK                       PH:"
4790 PRINT A3$;
4800 FOR I=1 TO N
4810   MAT READ FILE[4,(P-1)*(N+1)+I+1],S
4820   IF S[1]>-1000 THEN GOTO 4850
4830   PRINT "       CBD ";
4840   GOTO 4930
4850   PRINT USING "-----#.### ",S[1];
4860   READ FILE[4,(P-2)*(N+1)+1],C[1]
4870   IF C[1]<>9 THEN GOTO 4920
4880   MAT READ FILE[4,(P-2)*(N+1)+I+1],S3
4890   IF S3[1]<-1000 THEN GOTO 4920
4900   IF S3[1]>S[1] THEN GOTO 4920
4910   GOTO 4930

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
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AND ILLUSTRATIONS

EPA-287 (Cin.)
(4-76)

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C-O-N-T-I-N-U-O-U-S  F-L-O-W  A-N-A-L-Y-Z-E-R  A-U-T-O  S-Y-S-T-E-M
5/23/1980                                                    PAGE 13
                    PROGRAM LISTING FOR CFA08

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
4920   LET B[I]=S[1]
4930 NEXT I
4940 PRINT
4950 GOTO 0490
4960 REM    ------------------------------------------------------------
4970 REM            REMEASUREMENT POSITION
4980 LET A3$=A3$,"REPEAT OF [ ] ####.##  BCPH:"
4990 LET D2=1
5000 PRINT USING A3$,D2;
5010 GOSUB 5180
5020 PRINT "                                   CONC:";
5030 GOSUB 5450
5040 GOSUB 5360
5050 GOTO 0490
5060 REM    ------------------------------------------------------------
5070 REM            WRAP-UP PROCEDURE
5080 NOESC
5090 CALL 17
5100 WRITE FILE[4,0],N,A2$,R9$,W,W2,0
5110 CLOSE
5120 FOR I=1 TO 5
5130   PRINT
5140 NEXT I
5150 CHAIN "CFA10"
5160 REM    ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
5170 REM            SUBROUTINE TO CALCULATE BCPH AND FILL S2()
5180 FOR I=1 TO N
5190   MAT READ FILE[4,(P-1)*(N+1)+I+1],S
5200   FOR J=1 TO 14
5210     LET S2[I,J]=S[J]
5220   NEXT J
5230   IF P<>1 THEN GOTO 5260
5240   PRINT "        OK ";
5250   GOTO 5310
5260   IF S2[I,1]<-1000 THEN GOTO 5300
5270   LET S2[I,2]=S2[I,1]-B[I]
5280   PRINT USING "-----#.### ",S2[I,2];
5290   GOTO 5310
5300   PRINT "       CBD ";
5310 NEXT I
5320 PRINT
5330 RETURN

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
```

```
C-O-N-T-I-N-U-O-U-S  F-L-O-W  A-N-A-L-Y-Z-E-R  A-U-T-O  S-Y-S-T-E-M
5/23/1980                                                    PAGE 14
                    PROGRAM LISTING FOR CFA08

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
5340 REM    ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
5350 REM            SUBROUTINE TO COPY S2() BACK INTO CFA003
5360 FOR I=1 TO N
5370   FOR J=1 TO 14
5380     LET S[J]=S2[I,J]
5390   NEXT J
5400   MAT WRITE FILE[4,(P-1)*(N+1)+I+1],S
5410 NEXT I
5420 RETURN
5430 REM    ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
5440 REM            SUBROUTINE TO CALCULATE CONCENTRATION
5450 FOR I=1 TO N
5460   IF S2[I,1]<-1000 THEN GOTO 5730
5470   IF K5[I]=0 THEN GOTO 5500
5480   LET S2[I,12]=I6[I,1]+I6[I,2]*S2[I,2]+I6[I,3]*S2[I,2]^2+I6[I,4]*
*     S2[I,2]^3
5490   GOTO 5640
5500   IF S2[I,2]>I5[2*I-1,1] THEN GOTO 5560
5510   LET X1=0
5520   LET Y1=0
5530   LET X2=I5[2*I-1,1]
5540   LET Y2=I5[2*I,1]
5550   GOTO 5630
5560   FOR J=2 TO M7
5570     IF S2[I,2]<=I5[2*I-1,J] THEN GOTO 5590
5580   NEXT J
5590   LET X1=I5[2*I-1,J-1]
5600   LET Y1=I5[2*I,J-1]
5610   LET X2=I5[2*I-1,J]
5620   LET Y2=I5[2*I,J]
5630   LET S2[I,12]=((Y2-Y1)/(X2-X1))*(S2[I,2]-X1)+Y1
5640   IF S2[I,12]>=W5[I] THEN GOTO 5680
5650   IF C[1]=7 THEN GOTO 5680
5660   PRINT "       BDL ";
5670   GOTO 5750
5680   IF S2[I,12]<W6[I] THEN GOTO 5710
5690   PRINT "  OFFSCALE ";
5700   GOTO 5750
5710   PRINT USING "-----#.### ",S2[I,12]*D2;
5720   GOTO 5750
5730   PRINT "       CBD ";
5740   LET S2[I,12]=-99999

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
```

EPA-287 (Cin.)
(4-76)
AND ILLUSTRATIONS

```
C-O-N-T-I-N-U-O-U-S  F-L-O-W  A-N-A-L-Y-Z-E-R  A-U-T-O  S-Y-S-T-E-M
5/23/1980                                                      PAGE 15
                    PROGRAM LISTING FOR CFA08

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
5750 NEXT I
5760 PRINT
5770 RETURN
5780 REM    ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
5790 REM            SUBROUTINE TO FORMAT WHEEL POSITION
5800 LET A3$="000 (0/000)"
5810 LET A3$[4-LEN(STR$(O0)),3]=STR$(O0)
5820 LET A3$[6,6]=STR$(INT((O0-1)/W2)+1)
5830 LET A3$[11-LEN(STR$(O0-INT((O0-1)/W2)*W2)),10]=STR$(O0-INT((O0-1)
*    /W2)*W2)
5840 RETURN
5850 REM    ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
5860 REM            SUBROUTINE T) CHECK QC LIMITS
5870 LET W8=0
5880 LET W9=0
5890 PRINT "                                        QC:";
5900 FOR I=1 TO N
5910   IF R9[I]<>-99999 THEN GOTO 5940
5920   PRINT "      CBD ";
5930   GOTO 6120
5940   MAT READ FILE[4,(Q6-1)*(N+1)+1+I],S
5950   IF R9[I]<=S[3] THEN GOTO 5990
5960   PRINT "   UP CONT ";
5970   LET W9=W9+1
5980   GOTO 6120
5990   IF R9[I]<=S[4] THEN GOTO 6030
6000   PRINT "   UP WARN ";
6010   LET W8=W8+1
6020   GOTO 6120
6030   IF R9[I]>=S[7] THEN GOTO 6070
6040   PRINT "  LOW CONT ";
6050   LET W9=W9+1
6060   GOTO 6120
6070   IF R9[I]>=S[6] THEN GOTO 6110
6080   PRINT "  LOW WARN ";
6090   LET W8=W8+1
6100   GOTO 6120
6110   PRINT "        OK ";
6120 NEXT I
6130 PRINT
6140 IF W9=0 THEN GOTO 6190
6150 PRINT "<7>          <7>          <7>"

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
```

```
C-O-N-T-I-N-U-O-U-S  F-L-O-W  A-N-A-L-Y-Z-E-R  A-U-T-O  S-Y-S-T-E-M
5/23/1980                                                      PAGE 16
                    PROGRAM LISTING FOR CFA08

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
6160 PRINT "      QC CONTROL LIMIT EXCEEDED"
6170 PRINT
6180 GOTO 6230
6190 IF W8=0 THEN GOTO 6230
6200 PRINT "<7>          <7>"
6210 PRINT "      QC WARNING LIMIT EXCEEDED"
6220 PRINT
6230 RETURN

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
```

```
C-O-N-T-I-N-U-O-U-S   F-L-O-W   A-N-A-L-Y-Z-E-R   A-U-T-O   S-Y-S-T-E-M
5/23/1980                                                        PAGE 17
                      SYMBOL TABLE FOR CFA08

SYMBOL   REFERENCES
------   ----------------------------------------------------------------

 0110    0080  0620  1680
 0160    0100
 0320    0300
 0440    0420
 0490    1500  1710  2300  2450  2460  2580  3020  3500  4070  4340
         4480  4750  4950  5050
 0510    1370
 0630    0570
 0830    0780  0800
 0910    0870
 0940    0890
 1000    0920
 1040    0910
 1180    1140
 1200    1170
 1240    1120  1130
 1250    0990  1020  1090  1100  1110
 1290    1080
 1320    0560
 1470    1440
 1530    1440
 1690    1630
 1900    0330
 2270    2200
 2330    1440
 2390    2340
 2410    2380
 2540    2510
 2590    2480  2530
 2630    2600
 2640    2620
 2680    2560
 2710    2670
 3050    1440
 3210    3180
 3240    3210
 3250    3200  3230
 3270    3250
 3280    3260
 3300    3270
 3310    3290
 3370    3340
 3380    3360
 3450    3420
 3460    3440
```

```
C-O-N-T-I-N-U-O-U-S   F-L-O-W   A-N-A-L-Y-Z-E-R   A-U-T-O   S-Y-S-T-E-M
5/23/1980                                                        PAGE 18
                      SYMBOL TABLE FOR CFA08

SYMBOL   REFERENCES
------   ----------------------------------------------------------------

 3530    1440
 3690    3670
 3700    3680
 3720    3690
 3730    3710
 3760    3730
 3780    3750
 3840    3810
 3850    3830
 3920    3890
 3950    3920
 3960    3910  3940
 4050    3990  4000
 4060    4040
 4100    1440
 4270    4230
 4290    4260
 4370    1440
 4510    1440
 4610    4570
 4640    4600
 4730    4670  4680
 4740    4720
 4780    1440
 4850    4820
 4920    4870  4890  4900
 4930    4840  4910
 4980    1440
 5080    0500
 5180    1490  1550  2410  3120  3600  4120  4390  4540  5010
 5260    5230
 5300    5260
 5310    5250  5290
 5360    1610  2440  3490  4060  4330  4470  4740  5040
 5450    2430  3150  3640  4150  4410  5030
 5500    5470
 5560    5500
 5590    5570
 5630    5550
 5640    5490
 5680    5640  5650
 5710    5680
 5730    5460
 5750    5670  5700  5720
 5800    1410  2720  2750  2790
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EPA-287 (Cin.)
(4-76)

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C-O-N-T-I-N-U-O-U-S   F-L-O-W   A-N-A-L-Y-Z-E-R   A-U-T-O   S-Y-S-T-E-M
5/23/1980                                                         PAGE 19
                        SYMBOL TABLE FOR CFA08

SYMBOL    REFERENCES
------    ---------------------------------------------------------------
 5870   3480  4320  4460
 5940   5910
 5990   5950
 6030   5990
 6070   6030
 6110   6070
 6120   5930  5980  6020  6060  6100
 6190   6140
 6230   6180  6190
 A2$    0130  0160  0190  0460  1390  3010  5100
 A3$    0180  1420  1470  1480  1530  1540  2350  2360  2370  2390
        2400  2730  2760  2800  3050  3060  3110  3530  3540  3590
        3610  3620  3630  4100  4110  4370  4380  4510  4520  4530
        4780  4790  4980  5000  5800  5810  5820  5830
 A7     1950  2450
 A9[    0230  3190  3220  3240  3300  3340  3370  3740  3760  3770
        3890  3920  3990  4000
 B      1810  1960
 B7     0280
 B7[    0200  0640
 B8     0290
 B8[    0200  0640
 B[     0220  0390  4920  5270
 C[     0160  1430  1440  1700  1710  2330  2340  2360  2460  2590
        2640  2660  2680  2820  2830  2840  2850  2860  3060  3070
        3080  3090  3100  3110  3130  3190  3240  3300  3540  3550
        3560  3570  3580  4520  4610  4860  4870  5650
 D      0240  1900  2600  2610
 D2     1300  2330  2370  2400  3130  3300  3580  3590  3720  3770
        4130  4990  5000  5710
 D2[    0160  0640  0690  0720  0750  0960
 D8     2610  2630  2640  2660
 D[     0200  0520  0640
 E      0510
 E[     0200  0520  0560  0570  0840  1130  1250  1260  1290  1300
        1310
 F5     0700  0910  1110
 FL#4   0130  0190  0840  1310  1360  1430  1700  1760  2120  2590
        2680  2840  2850  2860  2880  2890  2900  2910  2980  3100
        3170  3570  3660  4610  4810  4860  4880  5100  5190  5400
        5940
 FL#5   0250  0260  0270  0280  0290  1810  1820  1830  1840  1850
        1860  1870  1900  1910  1920  1930  1940  1950  1960  1970
        1980  1990  2000  2010  2020  2040
 FL#6   0450  0460  1290  1300  1390
```

```
C-O-N-T-I-N-U-O-U-S   F-L-O-W   A-N-A-L-Y-Z-E-R   A-U-T-O   S-Y-S-T-E-M
5/23/1980                                                         PAGE 20
                        SYMBOL TABLE FOR CFA08

SYMBOL    REFERENCES
------    ---------------------------------------------------------------
 G2     0770  0780
 G7     1820  1970
 G7[    0200  0360  1100  1740  1780
 G8     1830  1980
 G8[    0220  0350  0960  1090  1730  1770
 G9     0270
 G9[    0200  0780  1110
 H8     0660  0790  0920  1000  1290
 H9     0670  0800  0810  0870  0910  1040  1090  1100  1110  1290
 I      0340  0350  0360  0370  0380  0390  0400  0630  0640  0650
        0680  0690  0700  0710  0720  0750  0790  0820  0830  0950
        0960  0970  1350  1360  1380  1570  1580  1590  1620  1630
        1690  1720  1730  1740  1760  1770  1780  1800  2030  2040
        2060  2080  2100  2120  2130  2140  2160  2170  2200  2210
        2220  2230  2240  2250  2260  2290  2470  2480  2490  2500
        2510  2520  2540  2550  2560  2570  2630  2870  2880  2890
        2900  2910  2920  2930  2960  2980  2990  3160  3170  3190
        3210  3220  3240  3250  3270  3280  3300  3310  3330  3340
        3370  3380  3410  3420  3450  3460  3650  3660  3670  3690
        3700  3720  3730  3740  3760  3770  3780  3800  3810  3840
        3850  3880  3890  3920  3960  3980  3990  4000  4050  4170
        4180  4190  4220  4230  4240  4270  4280  4290  4420  4430
        4440  4560  4570  4580  4610  4620  4630  4640  4660  4670
        4680  4730  4800  4810  4880  4920  4930  5120  5140  5180
        5190  5210  5260  5270  5280  5310  5360  5380  5400  5410
        5450  5460  5470  5480  5500  5530  5540  5570  5590  5600
        5610  5620  5630  5640  5680  5710  5740  5750  5900  5910
        5940  5950  5990  6030  6070  6120
 I3     1940
 I3[    0230  4680
 I5[    0210  2130  2140  2200  2210  2220  2230  2240  2250  2260
        5500  5530  5540  5570  5590  5600  5610  5620
 I6[    0220  2060  5480
 J      0740  0750  0760  1750  1760  1790  2050  2060  2070  2110
        2120  2130  2140  2150  2180  2190  2280  2950  2960  2970
        5200  5210  5220  5370  5380  5390  5560  5570  5580  5590
        5600  5610  5620
 K      0530  0560  0570  0640  0780  0790  0840  0850  0960  1090
        1100  1110  1130  1150  1160  1180  1190  1200  1220  1240
        1250  1260  1290  1300  1310  1320  2190  2200  2210  2220
        2230  2240  2250  2260  2270
 K5     1910
 K5[    0220  5470
 L      1840  1990
 L5     0710  0910  1110
```

AND ILLUSTRATIONS
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```
C-O-N-T-I-N-U-O-U-S   F-L-O-W   A-N-A-L-Y-Z-E-R   A-U-T-O   S-Y-S-T-E-M
5/23/1980                                                         PAGE 21
                      SYMBOL TABLE FOR CFA08

SYMBOL    REFERENCES
------    -----------------------------------------------------------
 L[       0200  0380  1130  1250  1260
 M        0720  0750  2040
 M7       2090  2180  5560
 M[       0180  2060
 N        0130  0190  0200  0210  0220  0230  0340  0460  0530  0840
          1290  1300  1310  1350  1360  1390  1430  1570  1620  1700
          1720  1760  2030  2110  2120  2170  2470  2500  2550  2590
          2680  2840  2850  2860  2870  2880  2890  2900  2910  2930
          2980  3100  3160  3170  3330  3410  3570  3650  3660  3800
          3880  3980  4170  4220  4420  4560  4610  4660  4800  4810
          4860  4880  5100  5180  5190  5360  5400  5450  5900  5940
 O0       1400  2710  2740  2780  5810  5820  5830
 P        0410  0490  0500  1080  1360  1390  1400  1430  1700  1750
          1870  2020  2090  2100  2590  2680  2830  4310  4450  4810
          4860  4880  5190  5230  5400
 P7       0850  1290
 P8       1850  2000
 P8[      0200  0370  0790  0850  1240  1250
 P9       0820  1120  1140  1150  1180  1240  1290
 Q0       3550  3620
 Q5       3070  3130  3180  3240
 Q6       3090  3100  3170  3560  3570  3660  4310  4450  5940
 Q7       3080
 R0       0730  0750  0770
 R9$      0130  0160  0190  5100
 R9[      0230  3280  3300  3420  3450  3700  3720  3730  3770  3810
          3840  4240  4270  4280  4430  4580  4620  4630  4670  4680
          5910  5950  5990  6030  6070
 S        0840  1310  1360  1760  2120  2880  2890  2900  2910  2980
          3170  3660  4610  4810  5190  5400  5940
 S$       0160  1430  2400  2590  2680  2770  2840  2850  2860  3100
          3570
 S2[      0220  1580  1630  2480  2510  2520  2560  2630  2960  3190
          3240  3250  3300  3690  3720  3770  4180  4230  4270  4430
          4570  4620  5210  5260  5270  5280  5380  5460  5480  5500
          5570  5630  5640  5680  5710  5740
 S3       4880
 S3[      0180  4890  4900
 S8       1860  2010
 S8[      0200  1150  1160  1180  1190  1200  1250
 S[       0160  0880  0930  0980  1000  1040  1370  1770  1780  2130
          2140  2940  2960  3210  3240  3270  3300  3670  3720  3770
          4620  4820  4850  4900  4920  5210  5380  5950  5990  6030
          6070
 U5       0250
```

```
C-O-N-T-I-N-U-O-U-S   F-L-O-W   A-N-A-L-Y-Z-E-R   A-U-T-O   S-Y-S-T-E-M
5/23/1980                                                         PAGE 22
                      SYMBOL TABLE FOR CFA08

SYMBOL    REFERENCES
------    -----------------------------------------------------------
 U5[      0220  1220
 U6       0260
 U6[      0220  1200
 V        0690  0700  0710  0790  0800  0810
 V8       0940  0960  0980
 W        0130  0190  0500  2590  2680  2710  2740  2780  2840  2850
          2860  2880  2890  2900  2910  2980  3000  5100
 W2       0130  0190  5100  5820  5830
 W5       1920
 W5[      0220  3210  3250  3270  3670  3690  4230  5640
 W6       1930
 W6[      0220  2480  2520  2630  3210  3250  3270  3670  3690  4230
          5680
 W8       5870  6010  6090  6190
 W9       5880  5970  6050  6140
 X1       5510  5590  5630
 X2       5530  5610  5630
 Y        0540  1010  1050  1290
 Y1       5520  5600  5630
 Y2       5540  5620  5630
 Z        0550  1210  1260  1290
 Z3       2210  2250
 Z4       2220  2260
 Z[       0170  1200  1210  1220  1230
```

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SECTION 11

PROGRAM CFA09 - CALIBRATOR

CFA09 is the program which performs calibration and creates the calibration curve plotting file while an automated run is in progress. It is entered by chaining from CFA08 after CFA08 has calculated the baseline corrected peak height for the last calibration standard. It chains back to CFA00 if the ESCAPE key is pressed.

CFA09 first copies from file CFA004 the number of the current peak and the array of specified degrees of least squares fit. It subtracts 5 from the current peak number to determine the number of calibration standards, and it then checks to be sure that there are enough calibration standards to perform the requested fits. If not, the program alerts the user, stops the real-time data acquisition, and chains back to CFA02.

9-1/8"

The program then performs the requested curve fitting for each analyte. Curve fitting is done by the familiar method of least squares which is described in other published sources[6] in more detail than can be reproduced here. For each regression, the program calculates a fitting error, which can more precisely be called a percent, relative, standard error of estimate. The formula for fitting error is

$$\text{Fitting Error} = \frac{(100)\sqrt{\dfrac{\sum(\text{Known conc.} - \text{Calc. Conc.})^2}{\text{Number of standards} - (\text{Degree} + 1)}}}{\text{Mean conc.}}$$

If the user has specified linear interpolation as the method of curve fitting, no regression is performed, and the fitting error is set equal to zero.

When all of the requested curve fitting has been accomplished, the fitting errors are displayed on the terminal.

Next, the program performs a forced origin least squares regression for each analyte, and a fitting error for each analyte is calculated.[2] When all of the analytes have been dealt with, the fitting errors are displayed on the terminal.

Finally, the program creates the calibration curve plot file, CFA006. It writes into CFA006 all of the data items listed in the file description for that file. The program then closes CFA006, and it chains back to CFA08.

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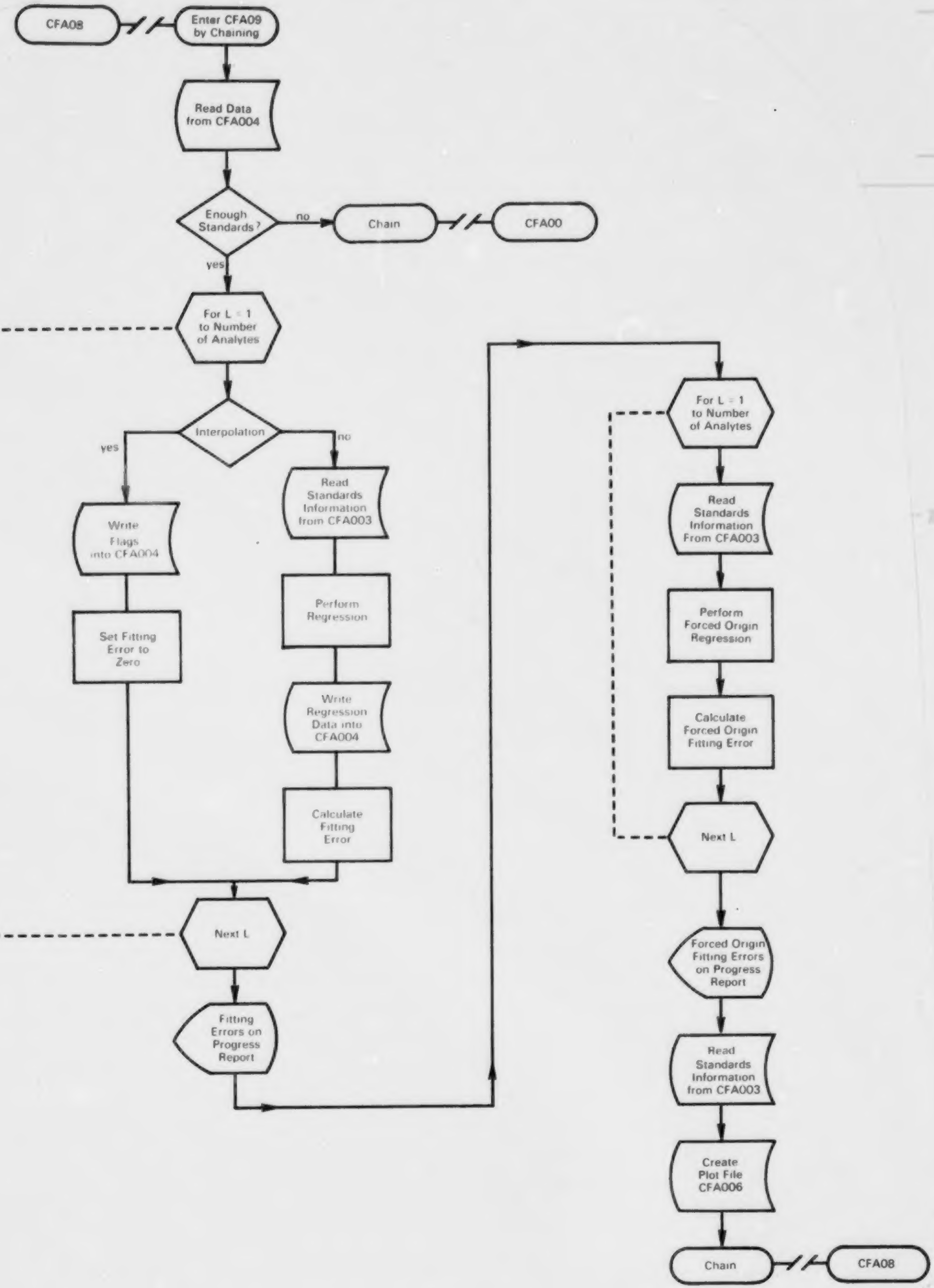
CFA08
Enter CFA09 by Chaining
Read Data from CFA004
Enough Standards?
no
Chain
CFA00
yes
For L = 1 to Number of Analytes
Interpolation
yes
no
Write Flags into CFA004
Set Fitting Error to Zero
Read Standards Information from CFA003
Perform Regression
Write Regression Data into CFA004
Calculate Fitting Error
Next L
Fitting Errors on Progress Report
For L = 1 to Number of Analytes
Read Standards Information From CFA003
Perform Forced Origin Regression
Calculate Forced Origin Fitting Error
Next L
Forced Origin Fitting Errors on Progress Report
Read Standards Information from CFA003
Create Plot File CFA006
Chain
CFA08

Figure 15 Functional Flowchart for Program CFA09

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TABLE 10. SYMBOL DEFINITIONS FOR CFA09

A2$	the superstring of the parameter-method codes
B5	the sum of the squares of the baseline corrected peak heights
F5()	the array of fitting errors for the requested fits
F6()	the array of fitting errors for the forced origin fits
I	the control variable for loops
J	the control variable for loops
K	the control variable for loops
K5()	the array of the degrees of fit
L	the control variable for loops
M7	the number of calibration standards
M8	the coefficient of the forced origin calibration equation
M()	the array of coefficients of the calibration equation
N	the number of analytes
P	the number of the peak currently being processed
Q()	an array used in regression calculations
R()	the array used in regression calculations
S7()	the array of the number of calibration standards for each analyte
S9	a holding variable used in the reduction of a matrix
S()	the array of data specific to one analyte for a peak; see symbol definitions for CFA03
T	the time between peaks
T5	the sum of the products of the theoretical concentrations and measured concentrations
T7	the concentration calculated from the forced origin equation
T8	the sum of the squares of the differences between the theoretical concentrations and calculated concentrations
T9	the sum of the theoretical concentrations
T()	an array used in regression calculations
U$	the superstring of default units
Z9	a variable used in the reduction of a matrix

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```
C-O-N-T-I-N-U-O-U-S   F-L-O-W   A-N-A-L-Y-Z-E-R   A-U-T-O   S-Y-S-T-E-M
5/23/1980                                                         PAGE  1
                     PROGRAM LISTING FOR CFA09

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
0010 REM   +=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+
0020 REM   +   CONTINUOUS FLOW ANALYZER AUTOMATION SYSTEM              +
0030 REM   +   PROGRAM CFA09, CALIBRATOR                               +
0040 REM   +   BY:  J. KOPKE (UCCC)     FEBRUARY 11, 1980              +
0050 REM   +   MOST RECENT REVISION:  APRIL 15, 1980                   +
0060 REM   +=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+
0070 REM
0080 ON ESC THEN GOTO 0110
0090 ESC
0100 GOTO 0150
0110 NOESC
0120 CALL 17
0130 CLOSE
0140 CHAIN "CFA00"
0150 DIM A2$[21],Q[7],R[4,5],S[14],T[5],M[4],U$[3]
0160 READ FILE[4,0],N,A2$
0170 DIM K5[N],F5[N],F6[N],S7[N]
0180 READ FILE[5,1],T,U$
0190 MAT READ FILE[5,8],K5
0200 READ FILE[5,21],P
0210 LET M7=P-5
0220 FOR I=1 TO N
0230   IF M7>=K5[I]+1 THEN IF M7>=2 THEN GOTO 0290
0240   PRINT "<7>          <7>          <7>          <7>          <7>"
0250   PRINT "     THERE ARE NOT ENOUGH CALIBRATION STANDARDS IN THE B
*    ATCH TO PERFORM"
0260   PRINT "     THE SPECIFIED REGRESSION;  THIS RUN IS BEING TERMIN
*    ATED"
0270   PRINT "<7>          <7>          <7>          <7>          <7>"
0280   GOTO 0110
0290 NEXT I
0300 REM   ____________________________________________________________
0310 REM           PERFORM CURVEFITTING
0320 FOR L=1 TO N
0330   IF K5[L]=0 THEN GOTO 1080
0340   REM   ___________________________________
0350   REM           POPULATE THE MATRICES
0360   MAT Q=ZER
0370   MAT R=ZER
0380   MAT T=ZER
0390   LET Q[1]=M7
0400   FOR I=6 TO P

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
```

```
C-O-N-T-I-N-U-O-U-S   F-L-O-W   A-N-A-L-Y-Z-E-R   A-U-T-O   S-Y-S-T-E-M
5/23/1980                                                         PAGE  2
                     PROGRAM LISTING FOR CFA09

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
0410      MAT READ FILE[4,(I-1)*(N+1)+1+L],S
0420      FOR J=2 TO 2*K5[L]+1
0430        LET Q[J]=Q[J]+S[2]^(J-1)
0440      NEXT J
0450      FOR K=1 TO K5[L]+1
0460        LET R[K,K5[L]+2]=T[K]+S[13]*S[2]^(K-1)
0470        LET T[K]=T[K]+S[13]*S[2]^(K-1)
0480      NEXT K
0490      LET T[K5[L]+2]=T[K5[L]+2]+S[13]^2
0500    NEXT I
0510    REM   ___________________________________
0520    REM           PERFORM REGRESSION
0530    FOR J=1 TO K5[L]+1
0540      FOR K=1 TO K5[L]+1
0550        LET R[J,K]=Q[J+K-1]
0560      NEXT K
0570    NEXT J
0580    FOR J=1 TO K5[L]+1
0590      FOR K=J TO K5[L]+1
0600        IF R[K,J]<>0 THEN GOTO 0670
0610      NEXT K
0620      PRINT "<7>          <7>          <7>          <7>          <7
*    >"
0630      PRINT "     THERE IS NO UNIQUE SOLUTION TO THE REGRESSION;  T
*    HIS RUN IS"
0640      PRINT "     BEING TERMINATED"
0650      PRINT "<7>          <7>          <7>          <7>          <7
*    >"
0660      GOTO 0110
0670      FOR I=1 TO K5[L]+2
0680        LET S9=R[J,I]
0690        LET R[J,I]=R[K,I]
0700        LET R[K,I]=S9
0710      NEXT I
0720      LET Z9=1/R[J,J]
0730      FOR I=1 TO K5[L]+2
0740        LET R[J,I]=Z9*R[J,I]
0750      NEXT I
0760      FOR K=1 TO K5[L]+1
0770        IF K=J THEN GOTO 0820
0780        LET Z9=(-1)*R[K,J]
0790        FOR I=1 TO K5[L]+2

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
```

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```
C-O-N-T-I-N-U-O-U-S   F-L-O-W   A-N-A-L-Y-Z-E-R   A-U-T-O   S-Y-S-T-E-M
5/23/1980                                                           PAGE  3
                        PROGRAM LISTING FOR CFA09

 1234567891123456789212345678931234567894123456789512345678961234567897
          0         0         0         0         0         0         0
0800          LET R[K,I]=R[K,I]+Z9*R[J,I]
0810        NEXT I
0820      NEXT K
0830    NEXT J
0840    REM   ------------------------------------
0850    REM           COPY EQUATION TO FILE CFA004
0860    MAT M=ZER
0870    FOR I=1 TO K5[L]+1
0880      LET M[I]=R[I,K5[L]+2]
0890    NEXT I
0900    MAT WRITE FILE[5,24+L],M
0910    REM   ------------------------------------
0920    REM           FITTING ERROR
0930    LET T8=0
0940    LET T9=0
0950    FOR I=6 TO P
0960      MAT READ FILE[4,(I-1)*(N+1)+1+L],S
0970      LET T7=M[1]+M[2]*S[2]+M[3]*S[2]^2+M[4]*S[2]^3
0980      LET T8=T8+(S[13]-T7)^2
0990      LET T9=T9+S[13]
1000    NEXT I
1010    IF M7-K5[L]-1>0 THEN GOTO 1040
1020    LET F5[L]=0
1030    GOTO 1130
1040    LET F5[L]=100*SQR(T8/(M7-K5[L]-1))/(T9/M7)
1050    GOTO 1130
1060    REM   ---------------------------------------------------------
1070    REM           LINEAR INTERPOLATION
1080    FOR I=1 TO 4
1090      LET M[I]=-99999
1100    NEXT I
1110    MAT WRITE FILE[5,24+L],M
1120    LET F5[L]=0
1130 NEXT L
1140 REM   ------------------------------------------------------------
1150 REM           DISPLAY FITTING ERROR
1160 PRINT
1170 PRINT "                 CALIBRATION FITTING ERROR:";
1180 FOR I=1 TO N
1190   PRINT USING " ----#.##% ",F5[I];
1200 NEXT I
1210 PRINT

 12345678911234567892 3456789312345678941234567895123456789612345678 97
          0                   0         0         0         0         0
```

```
C-O-N-T-I-N-U-O-U-S   F-L-O-W   A-N-A-L-Y-Z-E-R   A-U-T-O   S-Y-S-T-E-M
5/23/1980                                                           PAGE  4
                        PROGRAM LISTING FOR CFA09

 1234567891123456789212345678931234567894123456789512345678961234567897
          0         0         0         0         0         0         0
1220 REM   ------------------------------------------------------------
1230 REM           FORCED ORIGIN FIT
1240 FOR L=1 TO N
1250   LET T5=0
1260   LET B5=0
1270   FOR I=6 TO P
1280     MAT READ FILE[4,(I-1)*(N+1)+1+L],S
1290     LET T5=T5+S[2]*S[13]
1300     LET B5=B5+S[2]^2
1310   NEXT I
1320   LET M8=T5/B5
1330   REM   ------------------------------------
1340   REM           FORCED ORIGIN FITTING ERROR
1350   LET T8=0
1360   LET T9=0
1370   FOR I=6 TO P
1380     MAT READ FILE[4,(I-1)*(N+1)+1+L],S
1390     LET T7=M8*S[2]
1400     LET T8=T8+(S[13]-T7)^2
1410     LET T9=T9+S[13]
1420   NEXT I
1430   IF M7-1>0 THEN GOTO 1460
1440   LET F6[L]=0
1450   GOTO 1470
1460   LET F6[L]=100*SQR(T8/(M7-1))/(T9/M7)
1470 NEXT L
1480 REM   ------------------------------------------------------------
1490 REM           DISPLAY FORCED ORIGIN FITTING ERROR
1500 PRINT "              FORCED ORIGIN FITTING ERROR:";
1510 FOR I=1 TO N
1520   PRINT USING " ----#.##% ",F6[I];
1530 NEXT I
1540 PRINT
1550 MAT WRITE FILE[5,22],S7
1560 MAT WRITE FILE[5,23],F5
1570 MAT WRITE FILE[5,24],F6
1580 REM   ------------------------------------------------------------
1590 REM           CREATE PLOT FILE
1600 OPEN FILE[7,0],"CFA006",26
1610 WRITE FILE[7,0],N,A2$
1620 MAT WRITE FILE[7,1],K5
1630 FOR I=1 TO N

 1234567891123456789212345678931234567894123456789512345678961234567897
          0         0         0         0         0         0         0
```

```
C-O-N-T-I-N-U-O-U-S   F-L-O-W   A-N-A-L-Y-Z-E-R   A-U-T-O   S-Y-S-T-E-M
5/23/1980                                                     PAGE  5
                     PROGRAM LISTING FOR CFA09

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
1640   LET S7[I]=M7
1650 NEXT I
1660 MAT WRITE FILE[7,2],S7
1670 MAT WRITE FILE[7,3],F5
1680 MAT WRITE FILE[7,4],F6
1690 WRITE FILE[7,5],SYS(2),SYS(1),SYS(3)-1900,U$
1700 FOR I=1 TO N
1710   MAT READ FILE[5,24+I],M
1720   MAT WRITE FILE[7,5+I],M
1730 NEXT I
1740 FOR I=1 TO N
1750   FOR J=1 TO M7
1760     MAT READ FILE[4,(J+4)*(N+1)+1+I],S
1770     WRITE FILE[7,5+N+M7*(I-1)+J],S[2],S[13]
1780   NEXT J
1790 NEXT I
1800 CLOSE FILE[7]
1810 PRINT
1820 PRINT "     THE SECOND-TERMINAL CALIBRATION REPORT/PLOT IS NOW AV
*    AILABLE"
1830 PRINT
1840 NOESC
1850 CHAIN "CFA08"







1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
```

```
C-O-N-T-I-N-U-O-U-S   F-L-O-W   A-N-A-L-Y-Z-E-R   A-U-T-O   S-Y-S-T-E-M
5/23/1980                                                     PAGE  6
                     SYMBOL TABLE FOR CFA09

SYMBOL    REFERENCES
------   ----------------------------------------------------------------
  0110   0080  0280  0660
  0150   0100
  0290   0230
  0670   0600
  0820   0770
  1040   1010
  1080   0330
  1130   1030  1050
  1460   1430
  1470   1450
  A2$    0150  0160  1610
  B5     1260  1300  1320
  F5     1560  1670
  F5[    0170  1020  1040  1120  1190
  F6     1570  1680
  F6[    0170  1440  1460  1520
  FL#4   0160  0410  0960  1280  1380  1760
  FL#5   0180  0190  0200  0900  1110  1550  1560  1570  1710
  FL#7   1600  1610  1620  1660  1670  1680  1690  1720  1770  1800
  I      0220  0230  0290  0400  0410  0500  0670  0680  0690  0700
         0710  0730  0740  0750  0790  0800  0810  0870  0880  0890
         0950  0960  1000  1080  1090  1100  1180  1190  1200  1270
         1280  1310  1370  1380  1420  1510  1520  1530  1630  1640
         1650  1700  1710  1720  1730  1740  1760  1770  1790
  J      0420  0430  0440  0530  0550  0570  0580  0590  0600  0680
         0690  0720  0740  0770  0780  0800  0830  1750  1760  1770
         1780
  K      0450  0460  0470  0480  0540  0550  0560  0590  0600  0610
         0690  0700  0760  0770  0780  0800  0820
  K5     0190  1620
  K5[    0170  0230  0330  0420  0450  0460  0490  0530  0540  0580
         0590  0670  0730  0760  0790  0870  0880  1010  1040
  L      0320  0330  0410  0420  0450  0460  0490  0530  0540  0580
         0590  0670  0730  0760  0790  0870  0880  0900  0960  1010
         1020  1040  1110  1120  1130  1240  1280  1380  1440  1460
         1470
  M      0860  0900  1110  1710  1720
  M7     0210  0230  0390  1010  1040  1430  1460  1640  1750  1770
  M8     1320  1390
  M[     0150  0880  0970  1090
  N      0160  0170  0220  0320  0410  0960  1180  1240  1280  1380
         1510  1610  1630  1700  1740  1760  1770
  P      0200  0210  0400  0950  1270  1370
  Q      0360
  Q[     0150  0390  0430  0550
```

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```
C-O-N-T-I-N-U-O-U-S  F-L-O-W  A-N-A-L-Y-Z-E-R  A-U-T-O  S-Y-S-T-E-M
5/23/1980                                                  PAGE  7
                      SYMBOL TABLE FOR CFA09

SYMBOL   REFERENCES
------   ------------------------------------------------------------
 R       0370
 R[      0150  0460  0550  0600  0680  0690  0700  0720  0740  0780
         0800  0880
 S       0410  0960  1280  1380  1760
 S7      1550  1660
 S7[     0170  1640
 S9      0680  0700
 S[      0150  0430  0460  0470  0490  0970  0980  0990  1290  1300
         1390  1400  1410  1770
 T       0180  0380
 T5      1250  1290  1320
 T7      0970  0980  1390  1400
 T8      0930  0980  1040  1350  1400  1460
 T9      0940  0990  1040  1360  1410  1460
 T[      0150  0460  0470  0490
 U$      0150  0180  1690
 Z9      0720  0740  0780  0800
```

SECTION 12

PROGRAM CFA10 - BASELINE INTERPOLATOR

CFA10 is the program which interpolates the baseline height between the heights of the blanks scattered throughout the batch. CFA10 is entered by chaining from either CFA08 or CFA00. It chains back to CFA00 if the ESCAPE key is pressed.

CFA10 first checks whether CFA003, CFA004, and CFA006 exist. It then opens CFA003 and begins the baseline interpolation process.

Baseline interpolation is done across intervals between blanks. The program therefore always attempts to work from a "current blank" to the "next blank." The program begins by attempting to set the current blank height equal to that of the lower of the two blanks which are always present in wheel positions 4 and 5. If no peak height could be determined by CFA08 for either of these blanks, CFA10 uses zero as the current blank height and as the position of the current blank. There is also a message displayed on the terminal notifying the operator of this decision

Next, the program searches from the position of the current blank to the end of the batch to find the next blank for which CFA08 has provided a valid height. If a valid next blank is found, the program interpolates the baseline between the current blank and the next blank, and subtracts the interpolated height from the heights of all of the intervening samples. The formula for the interpolated baseline height is:

$$\text{Baseline height} = \frac{H2 - H1}{P2 - P1}\,(J-P1) + H1$$

where H1 is the height of the current blank, H2 is the height of the next blank, P1 is the position of the current blank, P2 is the position of the next blank, and J is the position of the intervening sample.

When the interpolation for the interval is complete, the program sets the current blank position and height equal to those of the next blank, and goes back to search for a new next blank.

When the program cannot find another next blank -- either because the run was aborted or because this program has reached the end of the batch -- it extends the current baseline height to the end of the batch, subtracting it from any remaining samples.

This entire process is repeated for each of the analytes. When the program has completed the task, it chains to CFA11.

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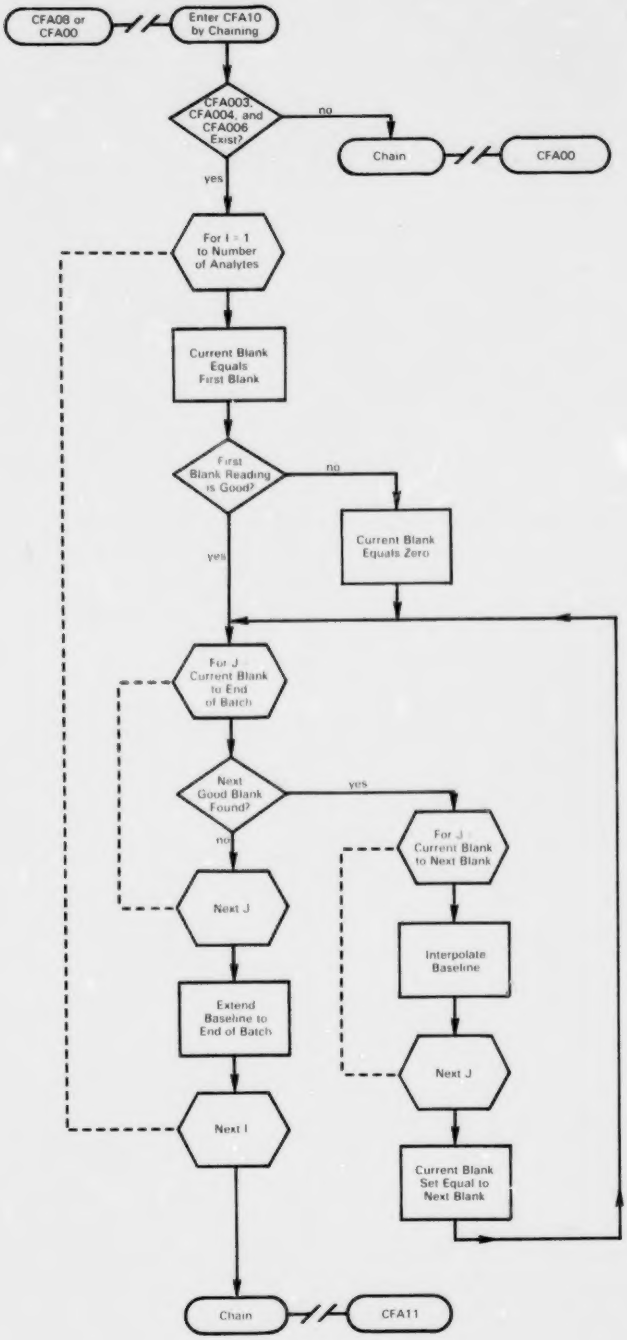
CFA08 or CFA00
Enter CFA10 by Chaining
CFA003, CFA004, and CFA006 Exist?
no
Chain
CFA00
yes
For I = 1 to Number of Analytes
Current Blank Equals First Blank
First Blank Reading is Good?
no
Current Blank Equals Zero
yes
For J = Current Blank to End of Batch
Next Good Blank Found?
yes
no
For J = Current Blank to Next Blank
Next J
Interpolate Baseline
Extend Baseline to End of Batch
Next J
Next I
Current Blank Set Equal to Next Blank
Chain
CFA11

Figure 16 Functional Flowchart of Program CFA10

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TABLE 11. SYMBOL DEFINITIONS FOR CFA10

A2$	the superstring of parameter-method codes
C()	the array of data common to all of the analytes for a wheel position; see symbol definitions for CFA03
D1	a counter for the number of intervals between blanks
H	the interpolated baseline height
H1	the height of the blank before an interval
H2	the height of the blank after an interval
I	the control variable for loops
J	the control variable for loops
N	the number of analytes
P1	the wheel position of the blank before an interval
R9$	the name of the run file
S()	the array of data specific to one analyte for a wheel position; see symbol definitions for CFA03
W	the number of wheel positions occupied by the batch

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PAGE NUMBER
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(4-76)

```
C-O-N-T-I-N-U-O-U-S   F-L-O-W   A-N-A-L-Y-Z-E-R   A-U-T-O   S-Y-S-T-E-M
5/23/1980                                                       PAGE  1
                     PROGRAM LISTING FOR CFA10

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
0010 REM   +=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+
0020 REM   +   CONTINUOUS FLOW ANALYZER AUTOMATION SYSTEM             +
0030 REM   +   PROGRAM CFA10, BASELINE INTERPOLATOR                   +
0040 REM   +   BY:  J. KOPKE (UCCC)     FEBRUARY 25, 1980             +
0050 REM   +   MOST RECENT REVISION:  APRIL 15, 1980                  +
0060 REM   +=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+
0070 REM
0080 DIM A2$[21],C[4],R9$[13],S[14]
0090 LET D1=0
0100 ON ESC THEN GOTO 0130
0110 ESC
0120 GOTO 0160
0130 NOESC
0140 CLOSE
0150 CHAIN "CFA00"
0160 ON ERR THEN GOTO 0180
0170 RENAME "CFA003","CFA003"
0180 ON ERR THEN STOP
0190 IF SYS(7)=-10 THEN GOTO 0290
0200 ON ERR THEN GOTO 0220
0210 RENAME "CFA004","CFA004"
0220 ON ERR THEN STOP
0230 IF SYS(7)=-10 THEN GOTO 0290
0240 ON ERR THEN GOTO 0260
0250 RENAME "CFA006","CFA006"
0260 ON ERR THEN STOP
0270 IF SYS(7)=-10 THEN GOTO 0290
0280 GOTO 0330
0290 PRINT
0300 PRINT "<7>THE SYSTEM DOES NOT HAVE SUFFICIENT DATA TO PERFORM ANY
*      POST-RUN"
0310 PRINT "PROCESSING"
0320 GOTO 0130
0330 OPEN FILE[4,0],"CFA003",56
0340 READ FILE[4,0],N,A2$,R9$,W
0350 ON ERR THEN GOTO 0370
0360 RENAME R9$,R9$
0370 ON ERR THEN STOP
0380 IF SYS(7)<>-9 THEN GOTO 0290
0390 PRINT
0400 PRINT "THE BASELINE IS BEING INTERPOLATED...";
0410 FOR I=1 TO N

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
```

```
C-O-N-T-I-N-U-O-U-S   F-L-O-W   A-N-A-L-Y-Z-E-R   A-U-T-O   S-Y-S-T-E-M
5/23/1980                                                       PAGE  2
                     PROGRAM LISTING FOR CFA10

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
0420   REM   -----------------------------------------------------------
0430   REM          FIND FIRST BLANK
0440   LET P1=-99999
0450   MAT READ FILE[4,3*(N+1)+1+I],S
0460   IF S[1]<-1000 THEN GOTO 0490
0470   LET P1=4
0480   LET H1=S[1]
0490   MAT READ FILE[4,4*(N+1)+1+I],S
0500   IF S[1]<-1000 THEN GOTO 0540
0510   IF H1<=S[1] THEN GOTO 0540
0520   LET P1=5
0530   LET H1=S[1]
0540   IF P1<>-99999 THEN GOTO 0570
0550   LET P1=0
0560   LET H1=0
0570   REM   -----------------------------------------------------------
0580   REM          FIND NEXT BLANK
0590   FOR J=P1+2 TO W
0600     READ FILE[4,(J-1)*(N+1)+1],C[1]
0610     IF C[1]<>9 THEN GOTO 0740
0620     MAT READ FILE[4,(J-1)*(N+1)+1+I],S
0630     IF S[1]<-1000 THEN GOTO 0740
0640     LET P2=J
0650     LET H2=S[1]
0660     READ FILE[4,J*(N+1)+1],C[1]
0670     IF C[1]<>9 THEN GOTO 0850
0680     MAT READ FILE[4,J*(N+1)+1+I],S
0690     IF S[1]<=1000 THEN GOTO 0850
0700     IF H2<=S[1] THEN GOTO 0850
0710     LET H2=S[1]
0720     LET H2=S[1]
0730     GOTO 0850
0740   NEXT J
0750   REM   -----------------------------------------------------------
0760   REM          EXTEND BASELINE TO END OF BATCH
0770   FOR J=P1+1 TO W
0780     MAT READ FILE[4,(J-1)*(N+1)+1+I],S
0790     LET S[2]=S[1]-H1
0800     MAT WRITE FILE[4,(J-1)*(N+1)+1+I],S
0810   NEXT J
0820   GOTO 0980
0830   REM   -----------------------------------------------------------

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
```

```
C-O-N-T-I-N-U-O-U-S   F-L-O-W   A-N-A-L-Y-Z-E-R   A-U-T-O   S-Y-S-T-E-M
5/23/1980                                                         PAGE  3
                      PROGRAM LISTING FOR CFA10

 1234567891123456789212345678931234567894123456789512345678961234567897
          0         0         0         0         0         0         0
 0840   REM          INTERPOLATE BASELINE BETWEEN BLANKS
 0850   FOR J=P1+1 TO P2-1
 0860     LET H=((H2-H1)/(P2-P1))*(J-P1)+H1
 0870     MAT READ FILE[4,(J-1)*(N+1)+1+I],S
 0880     LET S[2]=S[1]-H
 0890     MAT WRITE FILE[4,(J-1)*(N+1)+1+I],S
 0900   NEXT J
 0910   LET P1=P2
 0920   LET H1=H2
 0930   LET D1=D1+1
 0940   IF D1/5=INT(D1/5) THEN PRINT ".";
 0950   GOTO 0590
 0960   REM   ----------------------------------------------------------
 0970   REM          WRAP-UP PROCEDURE
 0980 NEXT I
 0990 PRINT "."
 1000 NOESC
 1010 CHAIN "CFA11"




 1234567891123456789212345678931234567894123456789512345678961234567897
          0         0         0         0         0         0         0
```

```
C-O-N-T-I-N-U-O-U-S   F-L-O-W   A-N-A-L-Y-Z-E-R   A-U-T-O   S-Y-S-T-E-M
5/23/1980                                                         PAGE  4
                       SYMBOL TABLE FOR CFA10

SYMBOL    REFERENCES
------  -------------------------------------------------------------
 0130   0100  0320
 0160   0120
 0180   0160
 0220   0200
 0260   0240
 0290   0190  0230  0270  0380
 0330   0280
 0370   0350
 0490   0460
 0540   0500  0510
 0570   0540
 0590   0950
 0740   0610  0630
 0850   0670  0690  0700  0730
 0980   0820
 A2$    0080  0340
 C[     0080  0600  0610  0660  0670
 D1     0090  0930  0940
 FL#4   0330  0340  0450  0490  0600  0620  0660  0680  0780  0800
        0870  0890
 H      0860  0880
 H1     0480  0510  0530  0560  0790  0860  0920
 H2     0650  0700  0710  0720  0860  0920
 I      0410  0450  0490  0620  0680  0780  0800  0870  0890  0980
 J      0590  0600  0620  0640  0660  0680  0740  0770  0780  0800
        0810  0850  0860  0870  0890  0900
 N      0340  0410  0450  0490  0600  0620  0660  0680  0780  0800
        0870  0890
 P1     0440  0470  0520  0540  0550  0590  0770  0850  0860  0910
 P2     0640  0850  0860  0910
 R9$    0080  0340  0360
 S      0450  0490  0620  0680  0780  0800  0870  0890
 S[     0080  0460  0480  0500  0510  0530  0630  0650  0690  0700
        0710  0720  0790  0880
 W      0340  0590  0770
```

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SECTION 13

PROGRAM CFA11 - RECALIBRATOR

CFA11 is the program which recalibrates after the baseline is interpolated between blanks and which allows the user to change the degree of fit and/or remove calibration standards from consideration. CFA11 is entered by chaining from CFA10. It chains back to CFA00 if the ESCAPE key is pressed. If the user selects the calibration report/plot feature, this program chains to CFA12, and when the report/plot is completed, CFA12 chains back into CFA11 at line 100.

When CFA11 is first entered, it immediately recalibrates all of the analytes using the new baseline corrected peak heights determined by CFA10. The entire calibration procedure is identical to that in CFA09 including the creation of the second terminal calibration plot file, CFA006.

CFA11 then presents the user with a menu of the following five options: 1) display the calibration report/plot on the current terminal, 2) suspend activity on this terminal while you get a second-terminal calibration report/plot, 3) change the degree of fit, 4) remove a calibration standard from consideration, or 5) none of the above. If the user does not respond in ten minutes (for example, in the case of an unattended night batch) the program assumes that the answer is "none of the above."

If the user chooses the first option, this program chains to CFA12.

If the user chooses the second option, this program goes to a timed input statement where it promts the user to press RETURN to resume activity on the primary terminal. If the user does not respond in ten minutes, the program sounds a bell as a reminder, and then restarts the ten minute timed input.

If the user chooses to change the degree of fit, the program reads the array of degrees of fit from file CFA004, allows the user to accept or change any or all of the values, writes the array back into CFA004, and then branches to the recalibration procedure again.

If the user chooses to remove a calibration standard from consideration, the program asks for the analyte and the wheel position of the bad standard. It then changes the baseline corrected peak height for that standard to -99999, and it branches to the recalibration procedure where any baseline corrected peak heights of -99999 are ignored. The original peak height of the standard is left unaltered so that a removed calibration standard can be restored by returning to program CFA10.

When the user chooses the last option, the program chains to CFA13.

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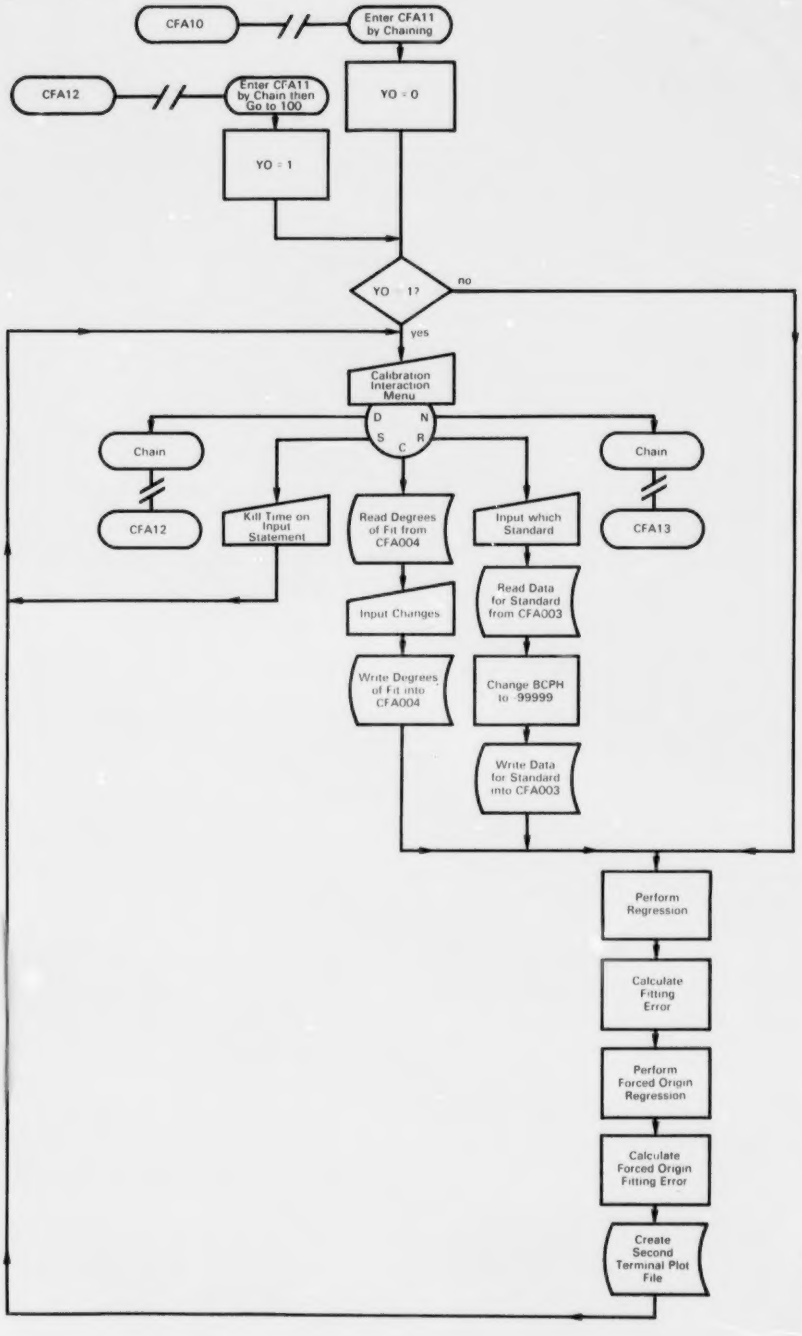
CFA10
Enter CFA11 by Chaining
CFA12
Enter CFA11 by Chain then Go to 100
YO = 0
YO = 1
YO = 1?
no
yes
Calibration Interaction Menu
D
N
S
C
R
Chain
CFA12
Kill Time on Input Statement
Read Degrees of Fit from CFA004
Input Changes
Write Degrees of Fit into CFA004
Input which Standard
Read Data for Standard from CFA003
Change BCPH to -99999
Write Data for Standard into CFA003
Chain
CFA13
Perform Regression
Calculate Fitting Error
Perform Forced Origin Regression
Calculate Forced Origin Fitting Error
Create Second Terminal Plot File

Figure 17 Functional Flowchart for Program CFA11

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(4-76)

TABLE 12. SYMBOL DEFINITIONS FOR CFA11

A	the number of the analyte for which a standard is removed
A$	the user's answer to several questions
A2$	the superstring of the parameter-method codes
B5	the sum of the squares of the baseline corrected peak heights
C0	a counter for the number of good standards found
C1	the total number of standards placed into file CFA006 for analytes before the current analyte
C()	the array of data common to all analytes for wheel position; see symbol definitions for CFA03
F5()	the array of fitting errors for the specified curve fittings
F6()	the array of fitting errors for the forced origin fits
I	the control variable for loops
J	the control variable for loops
K	the control variable for loops
K5()	the array of the specified degrees of fit
L	the control variable for a loop
M8	the coefficient of the forced origin regression
M()	the array of the coefficients of the calibration equation
N	the number of analytes
Q()	an array used in regression calculations
R9$	the name of the run file
R()	an array used in regression calculations
S7()	the array of the numbers of calibration standards
S9	a holding variable used in the reduction of a matrix
S()	the array of data specific to one analyte for a wheel position; see symbol definitions for CFA03
T	the time between peaks
T5	the sum of the products of the theoretical concentrations and the measured concentrations
T7	the calculated concentration from the forced origin fit
T8	the sum of the squares of the differences between the theoretical concentrations and calculated concentrations
T9	the sum of the theoretical concentrations
T()	an array used in regression calculations
U$	the superstring of default units
W	the number of wheel positions occupied by the batch
W0	the wheel position of the standard to be removed
Y0	a flag for which a 0 indicates that the program has been entered from CFA10, and a 1 indicates that the program has been entered from CFA12
Z9	a variable used in the reduction of a matrix

EPA-287 (Cin.)
(4-76)

```
C-O-N-T-I-N-U-O-U-S   F-L-O-W   A-N-A-L-Y-Z-E-R   A-U-T-O   S-Y-S-T-E-M
5/23/1980                                                          PAGE  1
                      PROGRAM LISTING FOR CFA11

1234567891123456789212345678931234567894123456789512345678961234567897
         0          0          0          0          0          0          0
0010 REM   +=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+
0020 REM   +   CONTINUOUS FLOW ANALYZER AUTOMATION SYSTEM                  +
0030 REM   +   PROGRAM CFA11, RECALIBRATOR                                 +
0040 REM   +   BY:  J. KOPKE (UCCC)      MARCH 3, 1980                     +
0050 REM   +   MOST RECENT REVISION:  APRIL 15, 1980                       +
0060 REM   +=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+
0070 REM
0080 LET Y0=0
0090 GOTO 0110
0100 LET Y0=1
0110 DIM A$[1],A2$[21],C[4],S[14],R9$[13],Q[7],R[4,5],T[5],M[4],U$[3]
0120 ON ESC THEN GOTO 0150
0130 ESC
0140 GOTO 0180
0150 NOESC
0160 CLOSE
0170 CHAIN "CFA00"
0180 IF Y0=1 THEN GOTO 0200
0190 OPEN FILE[5,0],"CFA004",22
0200 READ FILE[4,0],N,A2$,R9$,W
0210 DIM K5[N],F5[N],F6[N],S7[N]
0220 IF Y0=1 THEN GOTO 0330
0230 GOTO 1450
0240 PRINT
0250 PRINT "H = HELP"
0260 PRINT "D = DISPLAY CALIBRATION REPORT/PLOT ON THIS TERMINAL"
0270 PRINT "S = SUSPEND ACTIVITY ON THIS TERMINAL WHILE YOU GET A SECO
*     ND-TERMINAL"
0280 PRINT "        CALIBRATION REPORT/PLOT"
0290 PRINT "C = CHANGE THE DEGREE OF FIT"
0300 PRINT "R = REMOVE A CALIBRATION STANDARD FROM CONSIDERATION"
0310 PRINT "N = NONE OF THE ABOVE (THIS IS THE DEFAULT ANSWER IF THERE
*     IS"
0320 PRINT "        NO RESPONSE IN 10 MINUTES)"
0330 PRINT
0340 PRINT "CALIBRATION INTERACTION ([H],D,S,C,R,N) >>  ";
0350 TIME =600
0360 ON ERR THEN GOTO 0400
0370 TINPUT "",A$
0380 ON ERR THEN STOP
0390 GOTO 0450
0400 ON ERR THEN STOP

1234567891123456789212345678931234567894123456789512345678961234567897
         0          0          0          0          0          0          0
```

```
C-O-N-T-I-N-U-O-U-S   F-L-O-W   A-N-A-L-Y-Z-E-R   A-U-T-O   S-Y-S-T-E-M
5/23/1980                                                          PAGE  2
                      PROGRAM LISTING FOR CFA11

1234567891123456789212345678931234567894123456789512345678961234567897
         0          0          0          0          0          0          0
0410 IF SYS(7)<>60 THEN GOTO 0450
0420 PRINT
0430 PRINT "NO RESPONSE IN 10 MINUTES HAS IMPLIED AN ANSWER OF 'N'"
0440 LET A$="N"
0450 IF A$="" THEN GOTO 0240
0460 IF A$="H" THEN GOTO 0240
0470 IF A$="D" THEN GOTO 0570
0480 IF A$="S" THEN GOTO 0610
0490 IF A$="C" THEN GOTO 0740
0500 IF A$="R" THEN GOTO 0990
0510 IF A$="N" THEN GOTO 3310
0520 PRINT
0530 PRINT "<7>INVALID RESPONSE"
0540 GOTO 0240
0550 REM     ____________________________________________________________
0560 REM            DISPLAY CALIBRATION REPORT/PLOT
0570 NOESC
0580 CHAIN "CFA12"
0590 REM     ____________________________________________________________
0600 REM            SUSPEND ACTIVITY
0610 PRINT
0620 TIME =600
0630 PRINT "PRESS 'RETURN' TO RESUME ACTIVITY ON THIS TERMINAL >>  ";
0640 ON ERR THEN GOTO 0680
0650 TINPUT "",A$
0660 ON ERR THEN STOP
0670 GOTO 0330
0680 ON ERR THEN STOP
0690 IF SYS(7)<>60 THEN GOTO 0330
0700 PRINT "<7>          <7>          <7>          <7>"
0710 GOTO 0620
0720 REM     ____________________________________________________________
0730 REM            CHANGE DEGREE OF FIT
0740 MAT READ FILE[5,8],K5
0750 PRINT
0760 PRINT "DEGREE OF LEAST SQUARES FIT (0 = INTERPOLATION):"
0770 FOR I=1 TO N
0780   PRINT USING "     ####### ([#],",A2$[I*7-6,I*7],K5[I];
0790   ON ERR THEN GOTO 0810
0800   INPUT "---) >>  ",A$
0810   ON ERR THEN STOP
0820   IF A$="" THEN GOTO 0920

1234567891123456789212345678931234567894123456789512345678961234567897
         0          0          0          0          0          0          0
```

```
C-O-N-T-I-N-U-O-U-S  F-L-O-W  A-N-A-L-Y-Z-E-R  A-U-T-O  S-Y-S-T-E-M
5/23/1980                                                     PAGE  3
                       PROGRAM LISTING FOR CFA11

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
0830   IF A$="0" THEN GOTO 0910
0840   IF A$="1" THEN GOTO 0910
0850   IF A$="2" THEN GOTO 0910
0860   IF A$="3" THEN GOTO 0910
0870   PRINT
0880   PRINT "<7>     INVALID RESPONSE"
0890   PRINT
0900   GOTO 0780
0910   LET K5[I]=VAL(A$)
0920 NEXT I
0930 MAT WRITE FILE[5,8],K5
0940 PRINT
0950 PRINT "THIS CHANGE IS BEING PROCESSED..."
0960 GOTO 1480
0970 REM    ____________________________________________________________
0980 REM            REMOVE STANDARD
0990 IF N<>1 THEN GOTO 1070
1000 LET A=1
1010 GOTO 1240
1020 PRINT
1030 PRINT "H = HELP"
1040 FOR I=1 TO N
1050   PRINT USING "# = #######",I,A2$[I*7-6,I*7]
1060 NEXT I
1070 PRINT
1080 PRINT "ANALYTE ([H]";
1090 FOR I=1 TO N
1100   PRINT USING ",#",I;
1110 NEXT I
1120 ON ERR THEN GOTO 1140
1130 INPUT ") >>  ",A$
1140 ON ERR THEN STOP
1150 IF A$="" THEN GOTO 1020
1160 IF A$="H" THEN GOTO 1020
1170 IF A$="1" THEN GOTO 1230
1180 IF A$="2" THEN GOTO 1230
1190 IF N=3 THEN IF A$="3" THEN GOTO 1230
1200 PRINT
1210 PRINT "<7>INVALID RESPONSE"
1220 GOTO 1020
1230 LET A=VAL(A$)
1240 PRINT

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
```

```
C-O-N-T-I-N-U-O-U-S  F-L-O-W  A-N-A-L-Y-Z-E-R  A-U-T-O  S-Y-S-T-E-M
5/23/1980                                                     PAGE  4
                       PROGRAM LISTING FOR CFA11

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
1250 ON ERR THEN GOTO 1270
1260 INPUT "WHEEL POSITION OF STANDARD TO BE REMOVED >>  ",W0
1270 ON ERR THEN STOP
1280 IF W0=INT(W0) THEN IF W0>0 THEN IF W0<=W THEN GOTO 1320
1290 PRINT
1300 PRINT "<7>INVALID RESPONSE"
1310 GOTO 1240
1320 READ FILE[4,(W0-1)*(N+1)+1],C[1]
1330 IF C[1]=2 THEN GOTO 1370
1340 PRINT
1350 PRINT "<7>WHEEL POSITION ";W0;" IS NOT OCCUPIED BY A CALIBRATION
*    STANDARD"
1360 GOTO 1240
1370 MAT READ FILE[4,(W0-1)*(N+1)+1+A],S
1380 LET S[2]=-99999
1390 MAT WRITE FILE[4,(W0-1)*(N+1)+1+A],S
1400 PRINT
1410 PRINT "THIS CHANGE IS BEING PROCESSED..."
1420 GOTO 1480
1430 REM    ____________________________________________________________
1440 REM            RECALIBRATE
1450 PRINT
1460 PRINT "THE FINAL CALIBRATION EQUATIONS ARE BEING DEVELOPED..."
1470 READ FILE[5,1],T,U$
1480 MAT READ FILE[5,8],K5
1490 MAT S7=ZER
1500 FOR I=1 TO N
1510   FOR J=6 TO 30
1520     READ FILE[4,(J-1)*(N+1)+1],C[1]
1530     IF C[1]<>2 THEN GOTO 1570
1540     MAT READ FILE[4,(J-1)*(N+1)+1+I],S
1550     IF S[2]<>-99999 THEN LET S7[I]=S7[I]+1
1560   NEXT J
1570   IF S7[I]>=K5[I]+1 THEN IF S7[I]>=2 THEN GOTO 1620
1580   PRINT
1590   PRINT "<7>THERE ARE NOT ENOUGH STANDARDS IN THE BATCH TO PERFOR
*    M THE"
1600   PRINT "REGRESSION SPECIFIED FOR ";A2$[I*7-6,I*7]
1610   GOTO 0740
1620 NEXT I
1630 FOR L=1 TO N
1640   IF K5[L]=0 THEN GOTO 2450

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
```

EPA-287 (Cin.)
(4-76)

```
C-O-N-T-I-N-U-O-U-S   F-L-O-W   A-N-A-L-Y-Z-E-R   A-U-T-O   S-Y-S-T-E-M
5/23/1980                                                           PAGE  5
                      PROGRAM LISTING FOR CFA11

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
1650   REM   ________________________________
1660   REM          POPULATE THE MATRICES
1670   MAT Q=ZER
1680   MAT R=ZER
1690   MAT T=ZER
1700   LET C0=0
1710   LET Q[1]=S7[L]
1720   FOR I=6 TO 30
1730     MAT READ FILE[4,(I-1)*(N+1)+1+L],S
1740     IF S[2]=-99999 THEN GOTO 1850
1750     FOR J=2 TO 2*K5[L]+1
1760       LET Q[J]=Q[J]+S[2]^(J-1)
1770     NEXT J
1780     FOR K=1 TO K5[L]+1
1790       LET R[K,K5[L]+2]=T[K]+S[13]*S[2]^(K-1)
1800       LET T[K]=T[K]+S[13]*S[2]^(K-1)
1810     NEXT K
1820     LET T[K5[L]+2]=T[K5[L]+2]+S[13]^2
1830     LET C0=C0+1
1840     IF C0=S7[L] THEN GOTO 1880
1850   NEXT I
1860   REM   ________________________________
1870   REM          PERFORM REGRESSION
1880   FOR J=1 TO K5[L]+1
1890     FOR K=1 TO K5[L]+1
1900       LET R[J,K]=Q[J+K-1]
1910     NEXT K
1920   NEXT J
1930   FOR J=1 TO K5[L]+1
1940     FOR K=J TO K5[L]+1
1950       IF R[K,J]<>0 THEN GOTO 2000
1960     NEXT K
1970     PRINT
1980     PRINT "<7>THERE IS NO UNIQUE SOLUTION TO THE REGRESSION FOR "
*      ;A2$[I*7-6,I*7]
1990     GOTO 0330
2000     FOR I=1 TO K5[L]+2
2010       LET S9=R[J,I]
2020       LET R[J,I]=R[K,I]
2030       LET R[K,I]=S9
2040     NEXT I
2050     LET Z9=1/R[J,J]

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
```

```
C-O-N-T-I-N-U-O-U-S   F-L-O-W   A-N-A-L-Y-Z-E-R   A-U-T-O   S-Y-S-T-E-M
5/23/1980                                                           PAGE  6
                      PROGRAM LISTING FOR CFA11

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
2060     FOR I=1 TO K5[L]+2
2070       LET R[J,I]=Z9*R[J,I]
2080     NEXT I
2090     FOR K=1 TO K5[L]+1
2100       IF K=J THEN GOTO 2150
2110       LET Z9=(-1)*R[K,J]
2120       FOR I=1 TO K5[L]+2
2130         LET R[K,I]=R[K,I]+Z9*R[J,I]
2140       NEXT I
2150     NEXT K
2160   NEXT J
2170   REM   ________________________________
2180   REM          COPY EQUATION TO FILE CFA004
2190   MAT M=ZER
2200   FOR I=1 TO K5[L]+1
2210     LET M[I]=R[I,K5[L]+2]
2220   NEXT I
2230   MAT WRITE FILE[5,24+L],M
2240   REM   ________________________________
2250   REM          FITTING ERROR
2260   LET T8=0
2270   LET T9=0
2280   LET C0=0
2290   FOR I=6 TO 30
2300     MAT READ FILE[4,(I-1)*(N+1)+1+L],S
2310     IF S[2]=-99999 THEN GOTO 2370
2320     LET C0=C0+1
2330     LET T7=M[1]+M[2]*S[2]+M[3]*S[2]^2+M[4]*S[2]^3
2340     LET T8=T8+(S[13]-T7)^2
2350     LET T9=T9+S[13]
2360     IF C0=S7[L] THEN GOTO 2380
2370   NEXT I
2380   IF S7[L]-K5[L]-1>0 THEN GOTO 2410
2390   LET F5[L]=0
2400   GOTO 2500
2410   LET F5[L]=100*SQR(T8/(S7[L]-K5[L]-1))/(T9/S7[L])
2420   GOTO 2500
2430   REM   ________________________________
2440   REM          LINEAR INTERPOLATION
2450   FOR I=1 TO 4
2460     LET M[I]=-99999
2470   NEXT I

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
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PAGE NUMBER
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```
C-O-N-T-I-N-U-O-U-S   F-L-O-W   A-N-A-L-Y-Z-E-R   A-U-T-O   S-Y-S-T-E-M
5/23/1980                                                          PAGE  7
                        PROGRAM LISTING FOR CFA11

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
2480   MAT WRITE FILE[5,24+L],M
2490   LET F5[L]=0
2500 NEXT L
2510 REM   ------------------------------------
2520 REM           FORCED ORIGIN FIT
2530 FOR L=1 TO N
2540   LET T5=0
2550   LET B5=0
2560   LET C0=0
2570   FOR I=6 TO 30
2580     MAT READ FILE[4,(I-1)*(N+1)+1+L],S
2590     IF S[2]=-99999 THEN GOTO 2640
2600     LET C0=C0+1
2610     LET T5=T5+S[2]*S[13]
2620     LET B5=B5+S[2]^2
2630     IF C0=S7[L] THEN GOTO 2650
2640   NEXT I
2650   LET M8=T5/B5
2660   REM   ------------------------------------
2670   REM         FORCED ORIGIN FITTING ERROR
2680   LET T8=0
2690   LET T9=0
2700   LET C0=0
2710   FOR I=6 TO 30
2720     MAT READ FILE[4,(I-1)*(N+1)+1+L],S
2730     IF S[2]=-99999 THEN GOTO 2790
2740     LET C0=C0+1
2750     LET T7=M8*S[2]
2760     LET T8=T8+(S[13]-T7)^2
2770     LET T9=T9+S[13]
2780     IF C0=S7[L] THEN GOTO 2800
2790   NEXT I
2800   IF S7[L]-1>0 THEN GOTO 2830
2810   LET F6[L]=0
2820   GOTO 2840
2830   LET F6[L]=100*SQR(T8/(S7[L]-1))/(T9/S7[L])
2840 NEXT L
2850 MAT WRITE FILE[5,22],S7
2860 MAT WRITE FILE[5,23],F5
2870 MAT WRITE FILE[5,24],F6
2880 REM   ------------------------------------------------------------
2890 REM           CREATE PLOT FILE

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
```

```
C-O-N-T-I-N-U-O-U-S   F-L-O-W   A-N-A-L-Y-Z-E-R   A-U-T-O   S-Y-S-T-E-M
5/23/1980                                                          PAGE  8
                        PROGRAM LISTING FOR CFA11

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
2900 ON ERR THEN GOTO 2920
2910 RENAME "CFA006","CFA006"
2920 ON ERR THEN STOP
2930 IF SYS(7)<>-48 THEN GOTO 2990
2940 PRINT
2950 PRINT "<7>THE SYSTEM CANNOT PROCEED WHILE THE SECOND-TERMINAL CAL
*    IBRATION"
2960 PRINT "REPORT/PLOT FEATURE IS IN USE;  THERE WILL BE A 10-SECOND
*    DELAY"
2970 DELAY =10
2980 GOTO 2900
2990 ON ERR THEN GOTO 2920
3000 DELETE "CFA006"
3010 ON ERR THEN STOP
3020 OPEN FILE[7,0],"CFA006",26
3030 WRITE FILE[7,0],N,A2$
3040 MAT WRITE FILE[7,1],K5
3050 MAT WRITE FILE[7,2],S7
3060 MAT WRITE FILE[7,3],F5
3070 MAT WRITE FILE[7,4],F6
3080 WRITE FILE[7,5],SYS(2),SYS(1),SYS(3)-1900,U$
3090 FOR I=1 TO N
3100   MAT READ FILE[5,24+I],M
3110   MAT WRITE FILE[7,5+I],M
3120 NEXT I
3130 FOR I=1 TO N
3140   LET C1=5+N
3150   IF I>1 THEN LET C1=C1+S7[1]
3160   IF I>2 THEN LET C1=C1+S7[2]
3170   LET C0=0
3180   FOR J=6 TO 30
3190     MAT READ FILE[4,(J-1)*(N+1)+1+I],S
3200     IF S[2]=-99999 THEN GOTO 3240
3210     LET C0=C0+1
3220     WRITE FILE[7,C1+C0],S[2],S[13]
3230     IF C0=S7[I] THEN GOTO 3250
3240   NEXT J
3250 NEXT I
3260 CLOSE FILE[7]
3270 PRINT "THE SECOND-TERMINAL CALIBRATION REPORT/PLOT IS NOW AVAILAB
*    LE"
3280 GOTO 0330

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
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C-O-N-T-I-N-U-O-U-S   F-L-O-W   A-N-A-L-Y-Z-E-R   A-U-T-O   S-Y-S-T-E-M
5/23/1980                                                        PAGE  9
                        PROGRAM LISTING FOR CFA11

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
3290 REM  ____________________________________________________________
3300 REM           WRAP-UP PROCEDURE
3310 NOESC
3320 CHAIN "CFA13"
```

```
1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
```

```
C-O-N-T-I-N-U-O-U-S   F-L-O-W   A-N-A-L-Y-Z-E-R   A-U-T-O   S-Y-S-T-E-M
5/23/1980                                                       PAGE 10
                          SYMBOL TABLE FOR CFA11

SYMBOL    REFERENCES
______  ______________________________________________________________
 0110   0090
 0150   0120
 0180   0140
 0200   0180
 0240   0450  0460  0540
 0330   0220  0670  0690  1990  3280
 0400   0360
 0450   0390  0410
 0570   0470
 0610   0480
 0620   0710
 0680   0640
 0740   0490  1610
 0780   0900
 0810   0790
 0910   0830  0840  0850  0860
 0920   0820
 0990   0500
 1020   1150  1160  1220
 1070   0990
 1140   1120
 1230   1170  1180  1190
 1240   1010  1310  1360
 1270   1250
 1320   1280
 1370   1330
 1450   0230
 1480   0960  1420
 1570   1530
 1620   1570
 1850   1740
 1880   1840
 2000   1950
 2150   2100
 2370   2310
 2380   2360
 2410   2380
 2450   1640
 2500   2400  2420
 2640   2590
 2650   2630
 2790   2730
 2800   2780
 2830   2800
 2840   2820
```

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C-O-N-T-I-N-U-O-U-S   F-L-O-W   A-N-A-L-Y-Z-E-R   A-U-T-O   S-Y-S-T-E-M
5/23/1980                                                         PAGE 11
                          SYMBOL TABLE FOR CFA11

SYMBOL    REFERENCES
------    ----------------------------------------------------------------

 2900     2980
 2920     2900  2990
 2990     2930
 3240     3200
 3250     3230
 3310     0510
 A        1000  1230  1370  1390
 A$       0110  0370  0440  0450  0460  0470  0480  0490  0500  0510
          0650  0800  0820  0830  0840  0850  0860  0910  1130  1150
          1160  1170  1180  1190  1230
 A2$      0110  0200  0780  1050  1600  1980  3030
 B5       2550  2620  2650
 C0       1700  1830  1840  2280  2320  2360  2560  2600  2630  2700
          2740  2780  3170  3210  3220  3230
 C1       3140  3150  3160  3220
 C[       0110  1320  1330  1520  1530
 F5       2860  3060
 F5[      0210  2390  2410  2490
 F6       2870  3070
 F6[      0210  2810  2830
 FL#4     0200  1320  1370  1390  1520  1540  1730  2300  2580  2720
          3190
 FL#5     0190  0740  0930  1470  1480  2230  2480  2850  2860  2870
          3100
 FL#7     3020  3030  3040  3050  3060  3070  3080  3110  3220  3260
 I        0770  0780  0910  0920  1040  1050  1060  1090  1100  1110
          1500  1540  1550  1570  1600  1620  1720  1730  1850  1980
          2000  2010  2020  2030  2040  2060  2070  2080  2120  2130
          2140  2200  2210  2220  2290  2300  2370  2450  2460  2470
          2570  2580  2640  2710  2720  2790  3090  3100  3110  3120
          3130  3150  3160  3190  3230  3250
 J        1510  1520  1540  1560  1750  1760  1770  1880  1900  1920
          1930  1940  1950  2010  2020  2050  2070  2100  2110  2130
          2160  3180  3190  3240
 K        1780  1790  1800  1810  1890  1900  1910  1940  1950  1960
          2020  2030  2090  2100  2110  2130  2150
 K5       0740  0930  1480  3040
 K5[      0210  0780  0910  1570  1640  1750  1780  1790  1820  1880
          1890  1930  1940  2000  2060  2090  2120  2200  2210  2380
          2410
 L        1630  1640  1710  1730  1750  1780  1790  1820  1840  1880
          1890  1930  1940  2000  2060  2090  2120  2200  2210  2230
          2300  2360  2380  2390  2410  2480  2490  2500  2530  2580
          2630  2720  2780  2800  2810  2830  2840
 M        2190  2230  2480  3100  3110
```

```
C-O-N-T-I-N-U-O-U-S   F-L-O-W   A-N-A-L-Y-Z-E-R   A-U-T-O   S-Y-S-T-E-M
5/23/1980                                                         PAGE 12
                          SYMBOL TABLE FOR CFA11

SYMBOL    REFERENCES
------    ----------------------------------------------------------------

 M8       2650  2750
 M[       0110  2210  2330  2460
 N        0200  0210  0770  0990  1040  1090  1190  1320  1370  1390
          1500  1520  1540  1630  1730  2300  2530  2580  2720  3030
          3090  3130  3140  3190
 Q        1670
 Q[       0110  1710  1760  1900
 R        1680
 R9$      0110  0200
 R[       0110  1790  1900  1950  2010  2020  2030  2050  2070  2110
          2130  2210
 S        1370  1390  1540  1730  2300  2580  2720  3190
 S7       1490  2850  3050
 S7[      0210  1550  1570  1710  1840  2360  2380  2410  2630  2780
          2800  2830  3150  3160  3230
 S9       2010  2030
 S[       0110  1380  1550  1740  1760  1790  1800  1820  2310  2330
          2340  2350  2590  2610  2620  2730  2750  2760  2770  3200
          3220
 T        1470  1690
 T5       2540  2610  2650
 T7       2330  2340  2750  2760
 T8       2260  2340  2410  2680  2760  2830
 T9       2270  2350  2410  2690  2770  2830
 T[       0110  1790  1800  1820
 U$       0110  1470  3080
 W        0200  1280
 W0       1260  1280  1320  1350  1370  1390
 Y0       0080  0100  0180  0220
 Z9       2050  2070  2110  2130
```

SECTION 14

PROGRAM CFA12 - CALIBRATION REPORTER/PLOTTER

CFA12 is the program which produces a calibration report/plot on the user's main terminal. It is entered by chaining from CFA11. It chains back to CFA00 if the ESCAPE key is pressed.

The first question asked by CFA12 is the type of terminal. For this program, terminals fall into three categories: 1) Tektronix 4000 series computer display terminals, 2) Hewlett-Packard 2647 or 2648 terminals with Tektronix Compatibility Mode, and 3) neither of the above.

The program reads all of the general data necessary to produce a calibration report/plot from file CFA004. It then asks the user for the analyte of interest, and reads the data specific to that analyte from file CFA003.

Next, the program prints the heading information and the table of residuals. For terminals without plotting capability, the program terminates the report at this point.

For terminals with plotting capability, however, the program produces a calibration curve plot. The plotting is accomplished using a set of BASIC plotting subroutines which were developed by the Advanced Instrumentation Section, and which are documented separately.[5] The program first draws and labels the axes. It then puts the standards in order by increasing peak height and marks them on the graph. In the case of linear interpolation, the program connects the standards as it progresses to complete the drawing in one pass. The last segment of the interpolated curve is extended until it hits the side or top of the box. For other fits, the program draws the calculated calibration curve.

When the picture is complete, the program waits on a timed input statement until the user presses RETURN or until two minutes elapse to allow the user time to make a hard copy of the picture. A Hewlett-Packard terminal is then released from compatibility mode.

Finally, the program asks if the user wants a report/plot for another analyte. If the user does want to continue, the program branches back to ask for the new analyte of interest. Otherwise, the program chains to line 0100 of program CFA11.

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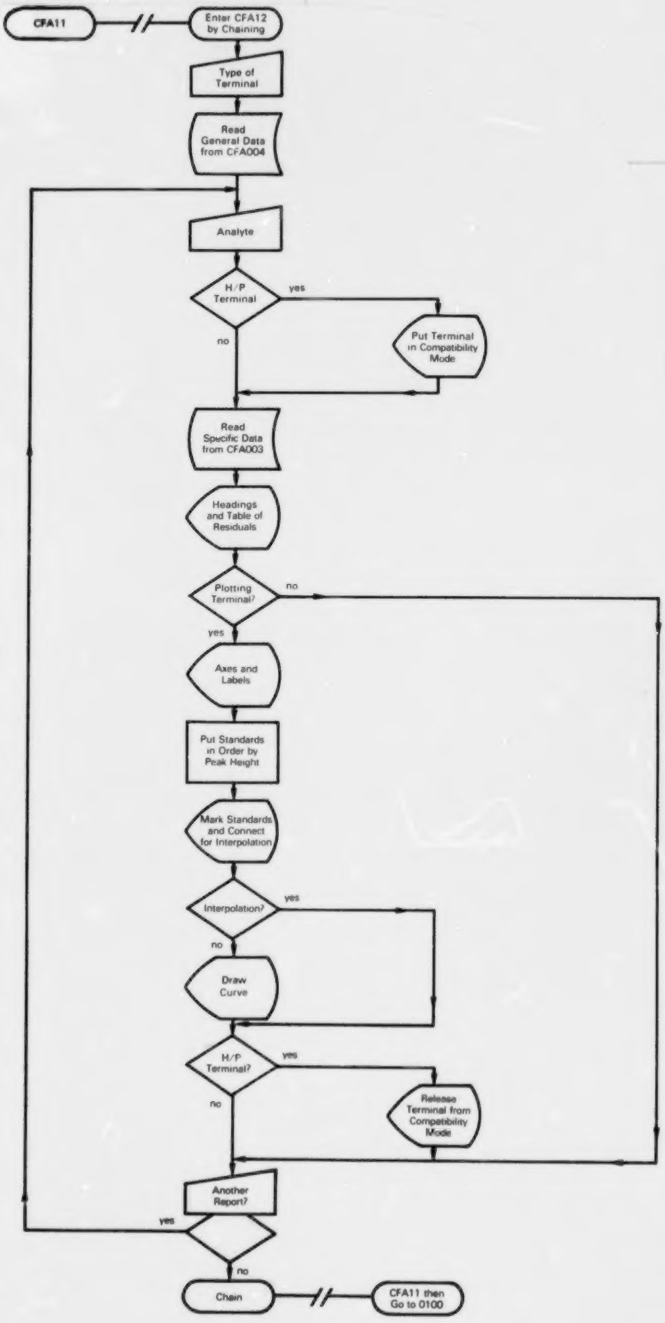
CFA11
Enter CFA12 by Chaining
Type of Terminal
Read General Data from CFA004
Analyte
H/P Terminal
yes
Put Terminal in Compatibility Mode
no
Read Specific Data from CFA003
Headings and Table of Residuals
Plotting Terminal?
no
yes
Axes and Labels
Put Standards in Order by Peak Height
Mark Standards and Connect for Interpolation
Interpolation?
yes
no
Draw Curve
H/P Terminal?
yes
Release Terminal from Compatibility Mode
no
Another Report?
yes
no
Chain
CFA11 then Go to 0100

Figure 18. Functional Flowchart for Program CFA12.

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TABLE 13. SYMBOL DEFINITIONS FOR CFA12

A	the number of the analyte under consideration
A$	the user's answer to several questions
A2$	the superstring of parameter-method codes
A3$	a general purpose string of formatted data
C	the measured concentration
C0	a counter for the number of good standards
D3	the month
D4	the day of the month
D5	the year
F5()	the array of calibration fitting errors
F6()	the array of forced origin fitting errors
I	the control variable for loops
I5()	the array of baseline corrected peaks heights and theoretical concentrations
J	the control variable for loops
K	the control variable for loops
K5()	the array of the degrees of fit
M()	the array of the coefficients of the calibration equation
N	the number of analytes
S7()	the array of the numbers of calibration standards
S()	the array of data specific to one analyte for a wheel position; see symbol definitions for CFA03
T	the time between peaks
T$	the type of terminal
U$	the superstring of default units
X5	the concentration corresponding to the left edge of the plot
X6	the concentration corresponding to the right edge of the plot
Z3	a holding variable used in a sorting process
Z4	a holding variable used in a sorting process

P1, P1$, P2, P2$, P3, P3$, P4, P4$, P5, P5$, P6, P7, P8, P9, P(), Q1, Q2, Q3, Q4, Q5, Q6, Q7, Q8, Q9, Q(), S1, S2, S3, S4, S5, S6, S7, S(), U1, U2, and U3 are symbols used by the plotting subroutines which are documented separately.[5]

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C-O-N-T-I-N-U-O-U-S  F-L-O-W  A-N-A-L-Y-Z-E-R  A-U-T-O  S-Y-S-T-E-M
5/23/1980                                                    PAGE  1
                     PROGRAM LISTING FOR CFA12

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
0010 REM   +=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+
0020 REM   +   CONTINUOUS FLOW ANALYZER AUTOMATION SYSTEM              +
0030 REM   +   PROGRAM CFA12, CALIBRATION REPORTER/PLOTTER             +
0040 REM   +   BY:  J. KOPKE (UCCC)      MARCH 4, 1980                 +
0050 REM   +   MOST RECENT REVISION:  APRIL 15, 1980                   +
0060 REM   +=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+
0070 REM
0080 PAGE =132
0090 DIM A2$[21],T$[1],A$[1],M[4],A3$[79],P[52],Q[52],I5[2,20],S[14]
0100 GOSUB 3360
0110 ON ESC THEN GOTO 0170
0120 ESC
0130 GOTO 0250
0140 PRINT "<27>E"
0150 DELAY =.7
0160 PRINT "<27>H<27>J"
0170 NOESC
0180 CLOSE
0190 CHAIN "CFA00"
0200 PRINT
0210 PRINT "H = HELP"
0220 PRINT "T = TEKTRONIX 4000 SERIES"
0230 PRINT "P = HEWLETT-PACKARD 2647 OR 2648"
0240 PRINT "N = NEITHER OF THE ABOVE"
0250 PRINT
0260 PRINT "TERMINAL TYPE ([H],T,P,N) >>  ";
0270 ON ERR THEN GOTO 0290
0280 INPUT "",T$
0290 ON ERR THEN STOP
0300 IF T$="" THEN GOTO 0200
0310 IF T$="H" THEN GOTO 0200
0320 IF T$="T" THEN GOTO 0380
0330 IF T$="P" THEN GOTO 0380
0340 IF T$="N" THEN GOTO 0380
0350 PRINT
0360 PRINT "<7>INVALID RESPONSE"
0370 GOTO 0200
0380 READ FILE[4,0],N,A2$
0390 DIM K5[N],S7[N],F5[N],F6[N],U$[3]
0400 READ FILE[5,1],T,U$
0410 MAT READ FILE[5,8],K5
0420 MAT READ FILE[5,22],S7

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
```

```
C-O-N-T-I-N-U-O-U-S  F-L-O-W  A-N-A-L-Y-Z-E-R  A-U-T-O  S-Y-S-T-E-M
5/23/1980                                                    PAGE  2
                     PROGRAM LISTING FOR CFA12

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
0430 MAT READ FILE[5,23],F5
0440 MAT READ FILE[5,24],F6
0450 LET D3=SYS(2)
0460 LET D4=SYS(1)
0470 LET D5=SYS(3)-1900
0480 IF N<>1 THEN GOTO 0560
0490 LET A=1
0500 GOTO 0760
0510 PRINT
0520 PRINT "H = HELP"
0530 FOR I=1 TO N
0540   PRINT USING "# = #######",I,A2$[I*7-6,I*7]
0550 NEXT I
0560 PRINT
0570 PRINT "ANALYTE ([H]";
0580 FOR I=1 TO N
0590   PRINT USING ",#",I;
0600 NEXT I
0610 PRINT ") >>  ";
0620 ON ERR THEN GOTO 0640
0630 INPUT "",A$
0640 ON ERR THEN STOP
0650 IF A$="" THEN GOTO 0510
0660 IF A$="H" THEN GOTO 0510
0670 IF A$="1" THEN GOTO 0730
0680 IF A$="2" THEN GOTO 0730
0690 IF N=3 THEN IF A$="3" THEN GOTO 0730
0700 PRINT
0710 PRINT "<7>INVALID RESPONSE"
0720 GOTO 0510
0730 LET A=VAL(A$)
0740 REM     ------------------------------------------------------------
0750 REM             PRINT CALIBRATION REPORT
0760 IF T$="N" THEN GOTO 0830
0770 IF T$="T" THEN GOTO 0800
0780 PRINT "<27>H<27>J<27>&S1P0Q"
0790 ON ESC THEN GOTO 0140
0800 PRINT "<27><12>";
0810 DELAY =1
0820 GOTO 0860
0830 FOR I=1 TO 5
0840   PRINT

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
```

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```
C-O-N-T-I-N-U-O-U-S   F-L-O-W   A-N-A-L-Y-Z-E-R   A-U-T-O   S-Y-S-T-E-M
5/23/1980                                                     PAGE  3
                    PROGRAM LISTING FOR CFA12

 1234567891123456789212345678931234567894123456789512345678961234567897
          0         0         0         0         0         0         0
 0850 NEXT I
 0860 PRINT "                     C-A-L-I-B-R-A-T-I-O-N   R-E-P-O-R-T"
 0870 LET A3$="ANALYTE: #######                              DATE OF CALI
*     BRATION: 00/00/00"
 0880 LET A3$[68-LEN(STR$(D3)),67]=STR$(D3)
 0890 LET A3$[71-LEN(STR$(D4)),70]=STR$(D4)
 0900 LET A3$[74-LEN(STR$(D5)),73]=STR$(D5)
 0910 PRINT USING A3$,A2$[A*7-6,A*7]
 0920 PRINT USING "DEGREE: #   FITTING ERROR: ###.##%   FORCED ORIGIN F
*     ITTING ERROR: ###.##%",K5[A],F5[A],F6[A]
 0930 IF K5[A]=0 THEN GOTO 1000
 0940 MAT READ FILE[5,24+A],M
 0950 PRINT USING "CONC = +#.##^^^^  +#.##^^^^ *BCPH",M[1],M[2];
 0960 IF K5[A]<2 THEN GOTO 1000
 0970 PRINT USING "  +#.##^^^^ *BCPH^2",M[3];
 0980 IF K5[A]<3 THEN GOTO 1000
 0990 PRINT USING "  +#.##^^^^ *BCPH^3",M[4];
 1000 PRINT
 1010 LET C0=0
 1020 FOR I=6 TO 30
 1030   MAT READ FILE[4,(I-1)*(N+1)+1+A],S
 1040   IF S[2]=-99999 THEN GOTO 1090
 1050   LET C0=C0+1
 1060   LET I5[1,C0]=S[2]
 1070   LET I5[2,C0]=S[13]
 1080   IF C0=S7[A] THEN GOTO 1100
 1090 NEXT I
 1100 PRINT
 1110 PRINT "         TCONC     CONC      DIFF"
 1120 PRINT "       ________  ________  ________"
 113C FOR I=1 TO S7[A]
 1140   IF K5[A]<>0 THEN GOTO 1170
 1150   LET C=I5[2,I]
 1160   GOTO 1180
 1170   LET C=M[1]+I5[1,I]*M[2]+I5[1,I]^2*M[3]+I5[1,I]^3*M[4]
 1180   PRINT USING "       ---#.### ---#.### ---#.###",I5[2,I],C,I5[
*     2,I]-C
 1190 NEXT I
 1200 IF T$="N" THEN GOTO 2720
 1210 REM   ------------------------------------------------------------
 1220 REM          LABEL AND DRAW VERTICAL AXIS
 1230 LET P1=0

 1234567891123456789212345678931234567894123456789512345678961234567897
          0         0         0         0         0         0         0
```

```
C-O-N-T-I-N-U-O-U-S   F-L-O-W   A-N-A-L-Y-Z-E-R   A-U-T-O   S-Y-S-T-E-M
5/23/1980                                                     PAGE  4
                    PROGRAM LISTING FOR CFA12

 1234567891123456789212345678931234567894123456789512345678961234567897
          0         0         0         0         0         0         0
 1240 LET P2=0
 1250 LET P3=0
 1260 GOSUB 3890
 1270 LET P2=670
 1280 LET P3=3
 1290 GOSUB 3890
 1300 LET A3$="BCPH IN PERCENT FULL SCALE"
 1310 FOR I=1 TO LEN(A3$)
 1320   PRINT A3$[I,I]
 1330 NEXT I
 1340 FOR I=1 TO 6
 1350   LET P2=74+(I-1)*121
 1360   IF I=1 THEN LET P2=P2+8
 1370   IF I=6 THEN LET P2=P2-5
 1380   GOSUB 3890
 1390   PRINT "<29>";P4$;"<31>";
 1400   PRINT USING "####",(I-1)*20
 1410 NEXT I
 1420 LET Q1=63
 1430 LET Q2=85
 1440 LET Q3=5
 1450 LET Q4=121
 1460 LET Q5=1
 1470 GOSUB 3530
 1480 LET Q1=998
 1490 LET Q5=-1
 1500 GOSUB 3530
 1510 REM   ------------------------------------------------------------
 1520 REM          LABEL AND DRAW HORIZONTAL AXIS
 1530 LET P1=0
 1540 LET P2=19
 1550 LET P3=3
 1560 GOSUB 3890
 1570 PRINT "<29>";P4$;"<31>";
 1580 PRINT "                   CONCENTRATION IN ";U$[A,A];"G/L"
 1590 LET S1=0
 1600 LET S2=0
 1610 FOR I=1 TO S7[A]
 1620   IF I5[2,I]>S2 THEN LET S2=I5[2,I]
 1630 NEXT I
 1640 GOSUB 2900
 1650 LET X5=S[1]

 1234567891123456789212345678931234567894123456789512345678961234567897
          0         0         0         0         0         0         0
```

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C-O-N-T-I-N-U-O-U-S   F-L-O-W   A-N-A-L-Y-Z-E-R   A-U-T-O   S-Y-S-T-E-M
5/23/1980                                                          PAGE  5
                        PROGRAM LISTING FOR CFA12

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
1660 LET X6=S[12]
1670 LET A3$="#.###"
1680 IF S[12]>=10 THEN LET A3$="##.##"
1690 IF S[12]>=100 THEN LET A3$="###.#"
1700 IF S[12]>=1000 THEN LET A3$="#####"
1710 LET P2=55
1720 FOR I=1 TO 12
1730   LET P1=28+(I-1)*85
1740   GOSUB 3890
1750   PRINT "<29>";P4$;"<31>";
1760   PRINT USING A3$,S[I]
1770 NEXT I
1780 LET Q1=63
1790 LET Q2=85
1800 LET Q3=11
1810 LET Q4=85
1820 LET Q5=2
1830 GOSUB 3530
1840 LET Q2=690
1850 LET Q5=-2
1860 GOSUB 3530
1870 REM ------------------------------------------------------------
1880 REM           PUT STANDARDS IN ORDER
1890 FOR J=S7[A] TO 2 STEP -1
1900   FOR K=2 TO J
1910     IF I5[1,K-1]<=I5[1,K] THEN GOTO 1980
1920     LET Z3=I5[1,K]
1930     LET Z4=I5[2,K]
1940     LET I5[1,K]=I5[1,K-1]
1950     LET I5[2,K]=I5[2,K-1]
1960     LET I5[1,K-1]=Z3
1970     LET I5[2,K-1]=Z4
1980   NEXT K
1990 NEXT J
2000 REM ------------------------------------------------------------
2010 REM           MARK STANDARDS -- CONNECT FOR INTERPOLATION ONLY
2020 LET P1=63
2030 LET P2=85
2040 LET P3=0
2050 GOSUB 3890
2060 LET P5$="0<8>+"
2070 FOR I=1 TO S7[A]

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
```

```
C-O-N-T-I-N-U-O-U-S   F-L-O-W   A-N-A-L-Y-Z-E-R   A-U-T-O   S-Y-S-T-E-M
5/23/1980                                                          PAGE  6
                        PROGRAM LISTING FOR CFA12

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
2080   LET P[I]=935*(I5[2,I]-X5)/(X6-X5)
2090   LET Q[I]=605*I5[1,I]/100
2100 NEXT I
2110 LET Q3=S7[A]
2120 LET Q7=-1
2130 IF K5[A]<>0 THEN GOTO 2190
2140 LET Q7=1
2150 LET P1=0
2160 LET P2=0
2170 LET P3=3
2180 GOSUB 3890
2190 GOSUB 3190
2200 IF K5[A]<>0 THEN GOTO 2360
2210 LET P1=P[S7[A]]
2220 LET P2=Q[S7[A]]
2230 LET P3=3
2240 GOSUB 3890
2250 LET P1=935
2260 LET P2=(Q[S7[A]]-Q[S7[A]-1])/(P[S7[A]]-P[S7[A]-1])*(935-P[S7[A]-1
*    ])+Q[S7[A]-1]
2270 IF P2<=605 THEN GOTO 2310
2280 LET P2=605
2290 LET P1=(P[S7[A]]-P[S7[A]-1])/(Q[S7[A]]-Q[S7[A]-1])*(605-Q[S7[A]-1
*    ])+P[S7[A]-1]
2300 IF P1>935 THEN GOTO 2540
2310 LET P3=2
2320 GOSUB 3890
2330 GOTO 2540
2340 REM ------------------------------------------------------------
2350 REM           DRAW CURVE
2360 LET Q3=1
2370 FOR I=0 TO 100 STEP 2
2380   LET Q[Q3]=605*I/100
2390   LET C=M[1]+I*M[2]+I^2*M[3]+I^3*M[4]
2400   LET P[Q3]=935*(C-X5)/(X6-X5)
2410   IF P[Q3]<0 THEN GOTO 2440
2420   IF P[Q3]>935 THEN GOTO 2440
2430   LET Q3=Q3+1
2440 NEXT I
2450 LET Q3=Q3-1
2460 LET P1=P[1]
2470 LET P2=Q[1]

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
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(4-76)

TYPING GUIDE SHEET
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C-O-N-T-I-N-U-O-U-S   F-L-O-W   A-N-A-L-Y-Z-E-R   A-U-T-O   S-Y-S-T-E-M
5/23/1980                                                          PAGE  7
                     PROGRAM LISTING FOR CFA12

1234567891123456789212345678931234567894123456789512345678961234567897
         0          0          0          0          0          0      0
2480 LET P3=3
2490 GOSUB 3890
2500 LET Q7=0
2510 GOSUB 3190
2520 REM    ------------------------------------------------------------
2530 REM          SOUND BELL -- ALLOW TIME FOR HARD COPY
2540 FOR I=1 TO 4
2550   PRINT "<7>"
2560   DELAY =.3
2570 NEXT I
2580 TIME =120
2590 ON ERR THEN GOTO 2610
2600 TINPUT "",A$
2610 ON ERR THEN STOP
2620 PRINT "<27><12>"
2630 DELAY =1
2640 IF T$<>"P" THEN GOTO 2710
2650 PRINT "<27>E"
2660 DELAY =.7
2670 ON ESC THEN GOTO 0170
2680 PRINT "<27>H<27>J"
2690 REM    ------------------------------------------------------------
2700 REM          WRAP-UP PROCEDURE
2710 GOTO 2750
2720 FOR I=1 TO 5
2730   PRINT
2740 NEXT I
2750 PRINT "ANOTHER REPORT ([N],Y) >>  ";
2760 ON ERR THEN GOTO 2780
2770 INPUT "",A$
2780 ON ERR THEN STOP
2790 IF A$="" THEN GOTO 2860
2800 IF A$="N" THEN GOTO 2860
2810 IF A$="Y" THEN GOTO 0480
2820 PRINT
2830 PRINT "<7>INVALID RESPONSE"
2840 PRINT
2850 GOTO 2710
2860 NOESC
2870 CHAIN "CFA11" THEN GOTO 0100
2880 REM    ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
2890 REM          SUBROUTINE TO PERFORM SCALING (BSCSCL.SR)

1234567891123456789212345678931234567894123456789512345678961234567897
         0          0          0          0          0          0      0
```

```
C-O-N-T-I-N-U-O-U-S   F-L-O-W   A-N-A-L-Y-Z-E-R   A-U-T-O   S-Y-S-T-E-M
5/23/1980                                                          PAGE  8
                     PROGRAM LISTING FOR CFA12

1234567891123456789212345678931234567894123456789512345678961234567897
         0          0          0          0          0          0      0
2900 LET S7=0
2910 LET S3=S2-S1
2920 IF S3>=100 THEN GOTO 2970
2930 LET S1=S1*10
2940 LET S2=S2*10
2950 LET S7=S7+1
2960 GOTO 2910
2970 LET S4=0
2980 IF S3<100 THEN GOTO 3020
2990 LET S3=S3/10
3000 LET S4=S4+1
3010 GOTO 2980
3020 IF S1=0 THEN IF S3-10*INT(S3/10)<=INT(S3/10) THEN LET S3=10*INT(S
*    3/10)
3030 LET S3=INT(S3+.5)
3040 IF S3-10*INT(S3/10)=0 THEN GOTO 3080
3050 IF S3-10*INT(S3/10)=5 THEN GOTO 3080
3060 LET S3=S3+1
3070 GOTO 3040
3080 LET S5=S3*10^(S4-1)
3090 LET S1=INT(S1/10^(S4-1))*10^(S4-1)
3100 IF S1/S5=INT(S1/S5) THEN GOTO 3130
3110 LET S1=S1-10^(S4-1)
3120 GOTO 3100
3130 FOR S6=1 TO 12
3140   LET S[S6]=(S1+(S6-1)*S5)/10^(S7)
3150 NEXT S6
3160 RETURN
3170 REM    ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
3180 REM          SUBROUTINE TO DRAW LINES AND CURVES (BSCLIN.SR)
3190 LET Q8=0
3200 LET P3=3
3210 IF Q7>=0 THEN LET P3=2
3220 FOR Q9=1 TO Q3
3230   LET P1=P[Q9]
3240   LET P2=Q[Q9]
3250   GOSUB 3890
3260   LET Q8=Q8+1
3270   IF Q8<>ABS(Q7) THEN GOTO 3320
3280   LET U1=P[Q9]
3290   LET U2=Q[Q9]
3300   GOSUB 3390

1234567891123456789212345678931234567894123456789512345678961234567897
         0          0          0          0          0          0      0
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C-O-N-T-I-N-U-O-U-S   F-L-O-W   A-N-A-L-Y-Z-E-R   A-U-T-O   S-Y-S-T-E-M
5/23/1980                                                          PAGE  9
                        PROGRAM LISTING FOR CFA12

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
3310   LET Q8=0
3320 NEXT Q9
3330 RETURN
3340 REM     ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
3350 REM          SUBROUTINE TO PLACE MARKERS (BSCMKR.SR)
3360 DIM P5$[10]
3370 GOSUB 3790
3380 RETURN
3390 LET P1=U1-5
3400 LET P2=U2-8
3410 LET U3=P3
3420 LET P3=3
3430 GOSUB 3890
3440 PRINT "<29>";P4$;
3450 PRINT "<31>";P5$[1,LEN(P5$)]
3460 LET P1=U1
3470 LET P2=U2
3480 GOSUB 3890
3490 LET P3=U3
3500 RETURN
3510 REM     ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
3520 REM          SUBROUTINE TO DRAW AXES (BSCAXS.SR)
3530 LET P1=Q1
3540 LET P2=Q2
3550 LET P3=3
3560 GOSUB 3890
3570 LET P3=2
3580 IF ABS(Q5)=1 THEN GOTO 3680
3590 FOR Q6=1 TO Q3+1
3600   GOSUB 3890
3610   LET P2=P2+10*Q5/ABS(Q5)
3620   GOSUB 3890
3630   LET P2=P2-10*Q5/ABS(Q5)
3640   GOSUB 3890
3650   LET P1=P1+Q4
3660 NEXT Q6
3670 RETURN
3680 FOR Q6=1 TO Q3+1
3690   GOSUB 3890
3700   LET P1=P1+10*Q5/ABS(Q5)
3710   GOSUB 3890
3720   LET P1=P1-10*Q5/ABS(Q5)

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
```

```
C-O-N-T-I-N-U-O-U-S   F-L-O-W   A-N-A-L-Y-Z-E-R   A-U-T-O   S-Y-S-T-E-M
5/23/1980                                                          PAGE 10
                        PROGRAM LISTING FOR CFA12

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
3730   GOSUB 3890
3740   LET P2=P2+Q4
3750 NEXT Q6
3760 RETURN
3770 REM     ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
3780 REM          SUBROUTINE TO PLOT INDIVIDUAL POINTS
3790 DIM P1$[32],P2$[32],P3$[32],P4$[4]
3800 LET P4=0
3810 LET P5=0
3820 LET P6=0
3830 LET P1$=" !<34>#$%&'()*+,-./0123456789:;<=>?"
3840 LET P2$="@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_"
3850 LET P3$="`ABCDEFGHIJKLM"
3860 LET P3$=P3$,"NOPQRSTUVWXY"
3870 LET P3$=P3$,"Z[\]^^"
3880 RETURN
3890 IF P3<>0 THEN GOTO 3930
3900 LET P4=P1
3910 LET P5=P2
3920 RETURN
3930 PRINT "<29>";
3940 IF LEN(P4$)<>0 THEN PRINT P4$[4,4];
3950 LET P7=INT(P1+P4)
3960 LET P8=INT(P2+P5)
3970 IF P7>1023 THEN LET P7=1023
3980 IF P7<0 THEN LET P7=0
3990 IF P8>780 THEN LET P8=780
4000 IF P8<0 THEN LET P8=0
4010 IF P3=2 THEN LET P6=1
4020 IF P3=3 THEN LET P6=0
4030 LET P9=INT(P8/32)
4040 LET P8=P8-(P9*32)+1
4050 LET P9=P9+1
4060 LET P4$=P1$[P9,P9],P3$[P8,P8]
4070 LET P9=INT(P7/32)
4080 LET P7=P7-(P9*32)+1
4090 LET P9=P9+1
4100 LET P4$=P4$,P1$[P9,P9],P2$[P7,P7]
4110 IF P6<>0 THEN GOTO 4130
4120 PRINT "<29>";
4130 PRINT P4$
4140 RETURN

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
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C-O-N-T-I-N-U-O-U-S   F-L-O-W   A-N-A-L-Y-Z-E-R   A-U-T-O   S-Y-S-T-E-M
5/23/1980                                                          PAGE 12
                        SYMBOL TABLE FOR CFA12

SYMBOL    REFERENCES
------  -------------------------------------------------------------------
 0100   2870
 0140   0790
 0170   0110  2670
 0200   0300  0310  0370
 0250   0130
 0290   0270
 0380   0320  0330  0340
 0480   2810
 0510   0650  0660  0720
 0560   0480
 0640   0620
 0730   0670  0680  0690
 0760   0500
 0800   0770
 0830   0760
 0860   0820
 1000   0930  0960  0980
 1090   1040
 1100   1080
 1170   1140
 1180   1160
 1980   1910
 2190   2130
 2310   2270
 2360   2200
 2440   2410  2420
 2540   2300  2330
 2610   2590
 2710   2640  2850
 2720   1200
 2750   2710
 2780   2760
 2860   2790  2800
 2900   1640
 2910   2960
 2970   2920
 2980   3010
 3020   2980
 3040   3070
 3080   3040  3050
 3100   3120
 3130   3100
 3190   2190  2510
 3320   3270
 3360   0100
```

```
C-O-N-T-I-N-U-O-U-S   F-L-O-W   A-N-A-L-Y-Z-E-R   A-U-T-O   S-Y-S-T-E-M
5/23/1980                                                          PAGE 13
                        SYMBOL TABLE FOR CFA12

SYMBOL    REFERENCES
------  -------------------------------------------------------------------
 3390   3300
 3530   1470  1500  1830  1860
 3680   3580
 3790   3370
 3890   1260  1290  1380  1560  1740  2050  2180  2240  2320  2490
        3250  3430  3480  3560  3600  3620  3640  3690  3710  3730
 3930   3890
 4130   4110
 A      0490  0730  0910  0920  0930  0940  0960  0980  1030  1080
        1130  1140  1580  1610  1890  2070  2110  2130  2200  2210
        2220  2260  2290
 A$     0090  0630  0650  0660  0670  0680  0690  0730  2600  2770
        2790  2800  2810
 A2$    0090  0380  0540  0910
 A3$    0090  0870  0880  0890  0900  0910  1300  1310  1320  1670
        1680  1690  1700  1760
 C      1150  1170  1180  2390  2400
 CO     1010  1050  1060  1070  1080
 D3     0450  0880
 D4     0460  0890
 D5     0470  0900
 F5     0430
 F5[    0390  0920
 F6     0440
 F6[    0390  0920
 FL#4   0380  1030
 FL#5   0400  0410  0420  0430  0440  0940
 I      0530  0540  0550  0580  0590  0600  0830  0850  1020  1030
        1090  1130  1150  1170  1180  1190  1310  1320  1330  1340
        1350  1360  1370  1400  1410  1610  1620  1630  1720  1730
        1760  1770  2070  2080  2090  2100  2370  2380  2390  2440
        2540  2570  2720  2740
 I5[    0090  1060  1070  1150  1170  1180  1620  1910  1920  1930
        1940  1950  1960  1970  2080  2090
 J      1890  1900  1990
 K      1900  1910  1920  1930  1940  1950  1960  1970  1980
 K5     0410
 K5[    0390  0920  0930  0960  0980  1140  2130  2200
 M      0940
 M[     0090  0950  0970  0990  1170  2390
 N      0380  0390  0480  0530  0580  0690  1030
 P1     1230  1530  1730  2020  2150  2210  2250  2290  2300  2460
        3230  3390  3460  3530  3650  3700  3720  3900  3950
 P1$    3790  3830  4060  4100
 P2     1240  1270  1350  1360  1370  1540  1710  2030  2160  2220
```

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C-O-N-T-I-N-U-O-U-S   F-L-O-W   A-N-A-L-Y-Z-E-R   A-U-T-O   S-Y-S-T-E-M
5/23/1980                                                        PAGE 14
                        SYMBOL TABLE FOR CFA12

SYMBOL    REFERENCES
-------   --------------------------------------------------------------

          2260  2270  2280  2470  3240  3400  3470  3540  3610  3630
          3740  3910  3960
 P2$      3790  3840  4100
 P3       1250  1280  1550  2040  2170  2230  2310  2480  3200  3210
          3410  3420  3490  3550  3570  3890  4010  4020
 P3$      3790  3850  3860  3870  4060
 P4       3800  3900  3950
 P4$      1390  1570  1750  3440  3790  3940  4060  4100  4130
 P5       3810  3910  3960
 P5$      2060  3360  3450
 P6       3820  4010  4020  4110
 P7       3950  3970  3980  4070  4080  4100
 P8       3960  3990  4000  4030  4040  4060
 P9       4030  4040  4050  4060  4070  4080  4090  4100
 P[       0090  2080  2210  2260  2290  2400  2410  2420  2460  3230
          3280
 Q1       1420  1480  1780  3530
 Q2       1430  1790  1840  3540
 Q3       1440  1800  2110  2360  2380  2400  2410  2420  2430  2450
          3220  3590  3680
 Q4       1450  1810  3650  3740
 Q5       1460  1490  1820  1850  3580  3610  3630  3700  3720
 Q6       3590  3660  3680  3750
 Q7       2120  2140  2500  3210  3270
 Q8       3190  3260  3270  3310
 Q9       3220  3230  3240  3280  3290  3320
 Q[       0090  2090  2220  2260  2290  2380  2470  3240  3290
 S        1030
 S1       1590  2910  2930  3020  3090  3100  3110  3140
 S2       1600  1620  2910  2940
 S3       2910  2920  2980  2990  3020  3030  3040  3050  3060  3080
 S4       2970  3000  3080  3090  3110
 S5       3080  3100  3140
 S6       3130  3140  3150
 S7       0420  2900  2950  3140
 S7[      0390  1080  1130  1610  1890  2070  2110  2210  2220  2260
          2290
 S[       0090  1040  1060  1070  1650  1660  1680  1690  1700  1760
          3140
 T        0400
 T$       0090  0280  0300  0310  0320  0330  0340  0760  0770  1200
          2640
 U$       0390  0400  1580
 U1       3280  3390  3460
 U2       3290  3400  3470
```

```
C-O-N-T-I-N-U-O-U-S   F-L-O-W   A-N-A-L-Y-Z-E-R   A-U-T-O   S-Y-S-T-E-M
5/23/1980                                                        PAGE 15
                        SYMBOL TABLE FOR CFA12

SYMBOL    REFERENCES
-------   --------------------------------------------------------------
 U3       3410  3490
 X5       1650  2080  2400
 X6       1660  2080  2400
 Z3       1920  1960
 Z4       1930  1970
```

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SECTION 15

PROGRAM CFA13 - REAGENT BLANK SUBTRACTOR

CFA13 is the program which allows the user to subtract reagent blanks. It is entered by chaining from CFA11. It chains back to CFA00 if the ESCAPE key is pressed.

CFA13 first scans file CFA003 to determine whether there are any reagent blanks in the batch. If there are not, this program chains directly to CFA14.

If there is at least one reagent blank in the batch, CFA13 presents the reagent blank interaction menu which allows the user to 1) display the reagent blank report, 2) subtract reagent blanks, or 3) neither of the above. If the user chooses the "neither" option, or if the user does not answer the question at all within two minutes (as during an unattended night batch) this program chains to CFA14.

If the user requests a reagent blank report, the program displays the baseline corrected peak heights and theoretical concentrations (if any) of all calibration standards, reagent blanks, and laboratory control standards in the batch.

If the user decides to subtract a reagent blank, the program allows for each analyte to be handled separately. The program asks for the amount to be subtracted and the first and last wheel positions from which the amount is to be subtracted. The program then subtracts the amount from the baseline corrected peak heights in file CFA003. It does not subtract from timing set standards, calibration standards, laboratory control standards, reagent blanks, instrument check standards, or blanks, even though they may be in the specified interval. The program then asks for another first and last wheel position. When the user types a zero as a wheel position, the program asks if it should deal with another analyte. If not, it chains to CFA14.

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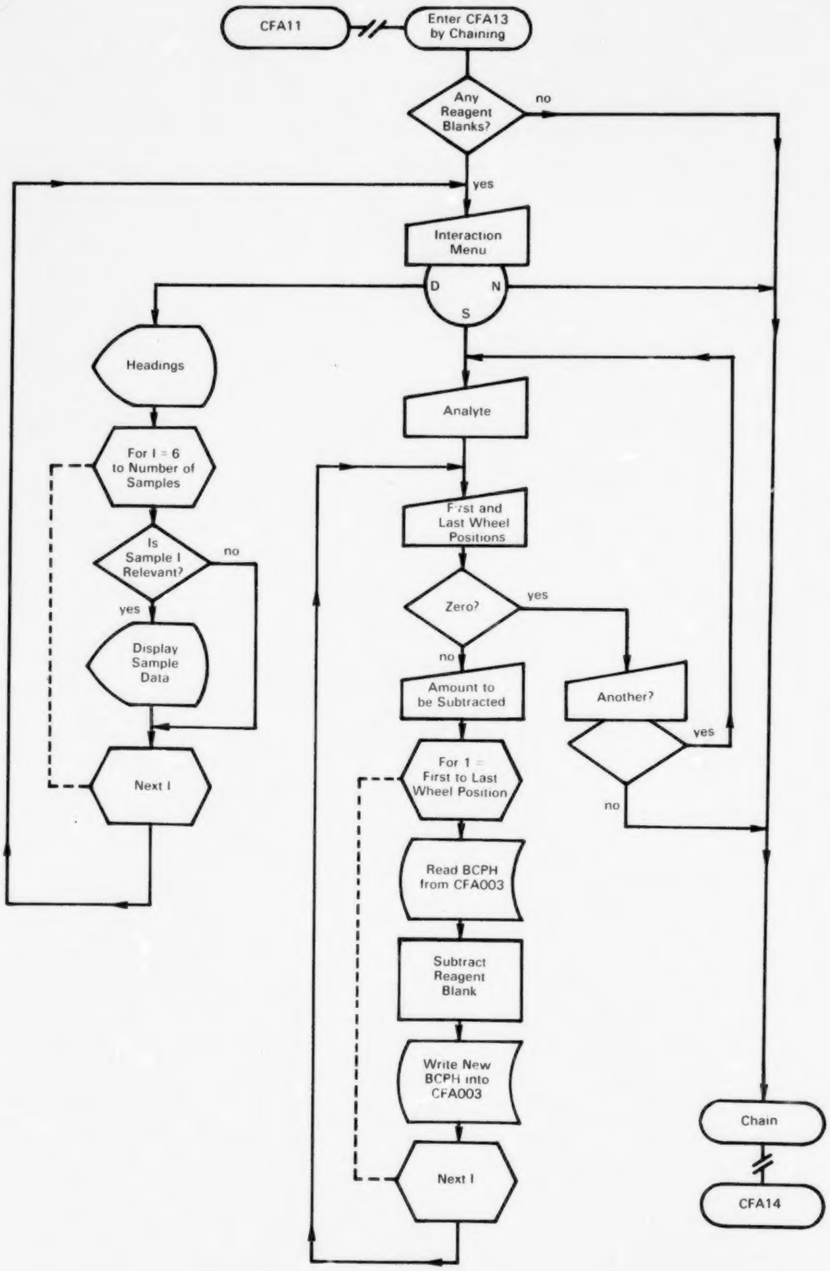
CFA11
Enter CFA13 by Chaining
Any Reagent Blanks?
no
yes
Interaction Menu
D
N
S
Headings
For I = 6 to Number of Samples
Is Sample I Relevant?
no
yes
Display Sample Data
Next I
Analyte
First and Last Wheel Positions
Zero?
yes
no
Amount to be Subtracted
Another?
yes
no
For 1 = First to Last Wheel Position
Read BCPH from CFA003
Subtract Reagent Blank
Write New BCPH into CFA003
Next I
Chain
CFA14

Figure 19. Functional Flowchart for Program CFA13.

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TABLE 14. SYMBOL DEFINITIONS FOR CFA13

A	the number of the analyte under consideration
A$	the user's answer to several questions
A2$	the superstring of parameter-method codes
A3$	a general purpose string of formatted data
BO	the value to be subtracted from the baseline corrected peak heights
C()	the array of data common to all analytes for a wheel position; see symbol definitions for CFA03
F9	the first wheel position from which the reagent blank is to be subtracted
I	the control variable for loops
J	the control variable for loops
L9	the last wheel position from which the reagent blank is to be subtracted
N	the number of analytes
OO	the wheel position being sent to the subroutine to be formatted
R9$	the name of the run file
S()	the array of data specific to one analyte for a wheel position; see symbol definitions for CFA03
W	the number of wheel positions occupied by the batch
W2	the number of positions in one wheel

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AND ILLUSTRATIONS

```
C-O-N-T-I-N-U-O-U-S   F-L-O-W   A-N-A-L-Y-Z-E-R   A-U-T-O   S-Y-S-T-E-M
5/23/1980                                                        PAGE  1
                      PROGRAM LISTING FOR CFA13

 1234567891123456789212345678931234567894123456789512345678961234567897
          0         0         0         0         0         0         0
 0010 REM   +=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+
 0020 REM   +   CONTINUOUS FLOW ANALYZER AUTOMATION SYSTEM                +
 0030 REM   +   PROGRAM CFA13, REAGENT BLANK SUBTRACTOR                   +
 0040 REM   +   BY:  J. KOPKE (UCCC)      MARCH 6, 1980                   +
 0050 REM   +   MOST RECENT REVISION:  APRIL 15, 1980                     +
 0060 REM   +=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+
 0070 REM
 0080 DIM A$[1],A2$[21],A3$[79],C[4],R9$[13],S[14]
 0090 ON ESC THEN GOTO 0120
 0100 ESC
 0110 GOTO 0150
 0120 NOESC
 0130 CLOSE
 0140 CHAIN "CFA00"
 0150 READ FILE[4,0],N,A2$,R9$,W,W2
 0160 FOR I=7 TO W
 0170   READ FILE[4,(I-1)*(N+1)+1],C[1]
 0180   IF C[1]=7 THEN GOTO 0280
 0190 NEXT I
 0200 NOESC
 0210 CHAIN "CFA14"
 0220 PRINT
 0230 PRINT "H = HELP"
 0240 PRINT "D = DISPLAY A REAGENT BLANK REPORT"
 0250 PRINT "S = SUBTRACT REAGENT BLANK"
 0260 PRINT "N = NONE OF THE ABOVE (THIS IS THE DEFAULT ANSWER IF THERE
*        IS"
 0270 PRINT "          NO RESPONSE IN 2 MINUTES"
 0280 PRINT
 0290 PRINT "REAGENT BLANK INTERACTION ([H],D,S,N) >>  ";
 0300 TIME =120
 0310 ON ERR THEN GOTO 0350
 0320 TINPUT "",A$
 0330 ON ERR THEN STOP
 0340 GOTO 0400
 0350 ON ERR THEN STOP
 0360 IF SYS(7)<>60 THEN GOTO 0400
 0370 PRINT
 0380 PRINT "NO RESPONSE IN 2 MINUTES HAS IMPLIED AN ANSWER OF 'N'"
 0390 LET A$="N"
 0400 IF A$="" THEN GOTO 0220
 0410 IF A$="H" THEN GOTO 0220

 1234567891123456789212345678931234567894123456789512345678961234567897
          0         0         0         0         0         0         0
```

```
C-O-N-T-I-N-U-O-U-S   F-L-O-W   A-N-A-L-Y-Z-E-R   A-U-T-O   S-Y-S-T-E-M
5/23/1980                                                        PAGE  2
                      PROGRAM LISTING FOR CFA13

 1234567891123456789212345678931234567894123456789512345678961234567897
          0         0         0         0         0         0         0
 0420 IF A$="D" THEN GOTO 0500
 0430 IF A$="S" THEN GOTO 1260
 0440 IF A$="N" THEN GOTO 1980
 0450 PRINT
 0460 PRINT "<7>INVALID RESPONSE"
 0470 GOTO 0220
 0480 REM   ------------------------------------------------------------
 0490 REM          REAGENT BLANK REPORT
 0500 FOR I=1 TO 5
 0510   PRINT
 0520 NEXT I
 0530 PRINT "                   R-E-A-G-E-N-T  B-L-A-N-K  R-E-P-O-R-T"
 0540 LET A3$="                                DATE:  00/00/00"
 0550 LET A3$[40-LEN(STR$(SYS(2))),39]=STR$(SYS(2))
 0560 LET A3$[43-LEN(STR$(SYS(1))),42]=STR$(SYS(1))
 0570 LET A3$[46-LEN(STR$(SYS(3)-1900)),45]=STR$(SYS(3)-1900)
 0580 PRINT A3$
 0590 PRINT
 0600 LET A3$="  WHEEL        SAMPLE   DILUTION    "
 0610 FOR I=1 TO N
 0620   LET A3$=A3$,"    ",A2$[I*7-6,I*7]
 0630 NEXT I
 0640 PRINT A3$
 0650 LET A3$=" POSITION        TYPE     FACTOR    "
 0660 FOR I=1 TO N
 0670   LET A3$=A3$,"   RESULTS"
 0680 NEXT I
 0690 PRINT A3$
 0700 LET A3$="----------  -----------  -------     "
 0710 FOR I=1 TO N
 0720   LET A3$=A3$,"  -------"
 0730 NEXT I
 0740 PRINT A3$
 0750 FOR I=1 TO W
 0760   READ FILE[4,(I-1)*(N+1)+1],C[1]
 0770   FOR J=1 TO N
 0780     MAT READ FILE[4,(I-1)*(N+1)+1+J],S
 0790     IF S[1]=-99999 THEN GOTO 1200
 0800   NEXT J
 0810   IF C[1]=2 THEN GOTO 0850
 0820   IF C[1]=6 THEN GOTO 0890
 0830   IF C[1]=7 THEN GOTO 0930

 1234567891123456789212345678931234567894123456789512345678961234567897
          0         0         0         0         0         0         0
```

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```
C-O-N-T-I-N-U-O-U-S   F-L-O-W   A-N-A-L-Y-Z-E-R   A-U-T-O   S-Y-S-T-E-M
5/23/1980                                                        PAGE  3
                     PROGRAM LISTING FOR CFA13

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
0840    GOTO 1190
0850    LET O0=I
0860    GOSUB 2020
0870    LET A3$=A3$,"  CAL STANDARD            BCPH:"
0880    GOTO 0960
0890    LET O0=I
0900    GOSUB 2020
0910    LET A3$=A3$,"  CONTROL STND            BCPH:"
0920    GOTO 0960
0930    LET O0=I
0940    GOSUB 2020
0950    LET A3$=A3$,"  REAGENT BLNK            BCPH:"
0960    PRINT A3$;
0970    FOR J=1 TO N
0980      MAT READ FILE[4,(I-1)*(N+1)+1+J],S
0990      IF S[1]>-1000 THEN GOTO 1020
1000      PRINT "       CBD ";
1010      GOTO 1060
1020      IF S[2]<>-99999 THEN GOTO 1050
1030      PRINT "   REMOVED ";
1040      GOTO 1060
1050      PRINT USING "-----#.### ",S[2];
1060    NEXT J
1070    PRINT
1080    IF C[1]=7 THEN GOTO 1190
1090    IF C[1]=2 THEN PRINT "                                    TCONC:
*       ";
1100    IF C[1]=6 THEN PRINT "                                      LCT:
*       ";
1110    FOR J=1 TO N
1120      MAT READ FILE[4,(I-1)*(N+1)+1+J],S
1130      IF C[1]=2 THEN IF S[2]=-99999 THEN GOTO 1160
1140      PRINT USING "-----#.### ",S[13];
1150      GOTO 1170
1160      PRINT "           ";
1170    NEXT J
1180    PRINT
1190 NEXT I
1200 FOR I=1 TO 5
1210   PRINT
1220 NEXT I
1230 GOTO 0280

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
```

```
C-O-N-T-I-N-U-O-U-S   F-L-O-W   A-N-A-L-Y-Z-E-R   A-U-T-O   S-Y-S-T-E-M
5/23/1980                                                        PAGE  4
                     PROGRAM LISTING FOR CFA13

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
1240 REM  ----------------------------------------------------------------
1250 REM            REAGENT BLANK SUBTRACTION
1260 IF N<>1 THEN GOTO 1340
1270 LET A=1
1280 GOTO 1510
1290 PRINT
1300 PRINT "H = HELP"
1310 FOR I=1 TO N
1320   PRINT USING "# = #######",I,A2$[I*7-6,I*7]
1330 NEXT I
1340 PRINT
1350 PRINT "ANALYTE ([H]";
1360 FOR I=1 TO N
1370   PRINT USING ",#",I;
1380 NEXT I
1390 ON ERR THEN GOTO 1410
1400 INPUT ") >>  ",A$
1410 ON ERR THEN STOP
1420 IF A$="" THEN GOTO 1290
1430 IF A$="H" THEN GOTO 1290
1440 IF A$="1" THEN GOTO 1500
1450 IF A$="2" THEN GOTO 1500
1460 IF A$="3" THEN IF N=3 THEN GOTO 1500
1470 PRINT
1480 PRINT "<7>INVALID RESPONSE"
1490 GOTO 1290
1500 LET A=VAL(A$)
1510 PRINT
1520 PRINT "SPECIFY WHEEL POSITIONS FROM WHICH THE REAGENT BLANK IS TO
     BE"
1530 PRINT "SUBTRACTED:  TYPE 0 (ZERO) AS A WHEEL POSITION TO END THE
     LIST"
1540 PRINT
1550 ON ERR THEN GOTO 1570
1560 INPUT "     FIRST POSITION >>  ",F9
1570 ON ERR THEN STOP
1580 IF F9=0 THEN GOTO 1870
1590 ON ERR THEN GOTO 1610
1600 INPUT "     LAST POSITION >>  ",L9
1610 ON ERR THEN STOP
1620 IF L9=0 THEN GOTO 1870
1630 IF F9<>INT(ABS(F9)) THEN GOTO 1680

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
```

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```
C-O-N-T-I-N-U-O-U-S  F-L-O-W  A-N-A-L-Y-Z-E-R  A-U-T-O  S-Y-S-T-E-M
5/23/1980                                                  PAGE  5
                    PROGRAM LISTING FOR CFA13

12345678911234567892123456789312345678941234567895123456789612345678 97
         0         0         0         0         0         0          0
1640 IF L9<>INT(ABS(L9)) THEN GOTO 1680
1650 IF L9<F9 THEN GOTO 1680
1660 IF L9>W THEN GOTO 1680
1670 GOTO 1710
1680 PRINT
1690 PRINT "<7>     INVALID RESPONSE"
1700 GOTO 1540
1710 ON ERR THEN GOTO 1730
1720 INPUT "     VALUE TO BE SUBTRACTED FROM BCPH >>  ",B0
1730 ON ERR THEN STOP
1740 FOR I=F9 TO L9
1750   READ FILE[4,(I-1)*(N+1)+1],C[1]
1760   IF C[1]=1 THEN GOTO 1850
1770   IF C[1]=2 THEN GOTO 1850
1780   IF C[1]=6 THEN GOTO 1850
1790   IF C[1]=7 THEN GOTO 1850
1800   IF C[1]=8 THEN GOTO 1850
1810   IF C[1]=9 THEN GOTO 1850
1820   MAT READ FILE[4,(I-1)*(N+1)+1+A],S
1830   LET S[2]=S[2]-B0
1840   MAT WRITE FILE[4,(I-1)*(N+1)+1+A],S
1850 NEXT I
1860 GOTO 1540
1870 IF N=1 THEN GOTO 1980
1880 PRINT
1890 ON ERR THEN GOTO 1910
1900 INPUT "ANOTHER ANALYTE ([N],Y) >>  ",A$
1910 ON ERR THEN STOP
1920 IF A$="" THEN GOTO 1980
1930 IF A$="N" THEN GOTO 1980
1940 IF A$="Y" THEN GOTO 1340
1950 PRINT
1960 PRINT "<7>INVALID RESPONSE"
1970 GOTO 1880
1980 NOESC
1990 CHAIN "CFA14"
2000 REM   +++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
2010 REM         SUBROUTINE TO FORMAT WHEEL POSITION
2020 LET A3$="000 (0/000)"
2030 LET A3$[4-LEN(STR$(O0)),3]=STR$(O0)
2040 LET A3$[6,6]=STR$(INT((O0-1)/W2)+1)
2050 LET A3$[11-LEN(STR$(O0-INT((O0-1)/W2)*W2)),10]=STR$(O0-INT((O0-1)
*     /W2)*W2)

12345678911234567892123456789312345678941234567895123456789612345678 97
         0         0         0         0         0         0          0
```

```
C-O-N-T-I-N-U-O-U-S  F-L-O-W  A-N-A-L-Y-Z-E-R  A-U-T-O  S-Y-S-T-E-M
5/23/1980                                                  PAGE  6
                    PROGRAM LISTING FOR CFA13

12345678911234567892123456789312345678941234567895123456789612345678 97
         0         0         0         0         0         0          0
2060 RETURN

12345678911234567892123456789312345678941234567895123456789612345678 97
         0         0         0         0         0         0          0
```

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C-O-N-T-I-N-U-O-U-S   F-L-O-W   A-N-A-L-Y-Z-E-R   A-U-T-O   S-Y-S-T-E-M
5/23/1980                                                        PAGE  7
                         SYMBOL TABLE FOR CFA13

SYMBOL    REFERENCES
------   ----------------------------------------------------------------
 0120   0090
 0150   0110
 0220   0400  0410  0470
 0280   0180  1230
 0350   0310
 0400   0340  0360
 0500   0420
 0850   0810
 0890   0820
 0930   0830
 0960   0880  0920
 1020   0990
 1050   1020
 1060   1010  1040
 1160   1130
 1170   1150
 1190   0840  1080
 1200   0790
 1260   0430
 1290   1420  1430  1490
 1340   1260  1940
 1410   1390
 1500   1440  1450  1460
 1510   1280
 1540   1700  1860
 1570   1550
 1610   1590
 1680   1630  1640  1650  1660
 1710   1670
 1730   1710
 1850   1760  1770  1780  1790  1800  1810
 1870   1580  1620
 1880   1970
 1910   1890
 1980   0440  1870  1920  1930
 2020   0860  0900  0940
 A      1270  1500  1820  1840
 A$     0080  0320  0390  0400  0410  0420  0430  0440  1400  1420
        1430  1440  1450  1460  1500  1900  1920  1930  1940
 A2$    0080  0150  0620  1320
 A3$    0080  0540  0550  0560  0570  0580  0600  0620  0640  0650
        0670  0690  0700  0720  0740  0870  0910  0950  0960  2020
        2030  2040  2050
 B0     1720  1830
 C[     0080  0170  0180  0760  0810  0820  0830  1080  1090  1100
```

```
C-O-N-T-I-N-U-O-U-S   F-L-O-W   A-N-A-L-Y-Z-E-R   A-U-T-O   S-Y-S-T-E-M
5/23/1980                                                        PAGE  8
                         SYMBOL TABLE FOR CFA13

SYMBOL    REFERENCES
------   ----------------------------------------------------------------
        1130  1750  1760  1770  1780  1790  1800  1810
 F9     1560  1580  1630  1650  1740
 FL#4   0150  0170  0760  0780  0980  1120  1750  1820  1840
 I      0160  0170  0190  0500  0520  0610  0620  0630  0660  0680
        0710  0730  0750  0760  0780  0850  0890  0930  0980  1120
        1190  1200  1220  1310  1320  1330  1360  1370  1380  1740
        1750  1820  1840  1850
 J      0770  0780  0800  0970  0980  1060  1110  1120  1170
 L9     1600  1620  1640  1650  1660  1740
 N      0150  0170  0610  0660  0710  0760  0770  0780  0970  0980
        1110  1120  1260  1310  1360  1460  1750  1820  1840  1870
 O0     0850  0890  0930  2030  2040  2050
 R9$    0080  0150
 S      0780  0980  1120  1820  1840
 S[     0080  0790  0990  1020  1050  1130  1140  1830
 W      0150  0160  0750  1660
 W2     0150  2040  2050
```

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(4-76)

SECTION 16

PROGRAM CFA14 - REPEAT POSITION IDENTIFIER

Extra repeat positions are wheel positions where a user may place a sample to be remeasured even though the system does not see a need for remeasurement. CFA14 is the program which allows the user to identify the remeasured samples by associating them with their original wheel positions. The program is entered by chaining from CFA13. It chains back to CFA00 if the ESCAPE key is pressed.

CFA14 first scans the file CFA003 to determine if there are any extra repeat positions included in the batch. If there are none, the program chains directly to CFA15.

If there is at least one extra repeat position, the program presents the repeat positions interaction menu which allows the user to 1) display the extra repeat positions report, 2) identify extra repeat positions, or 3) neither of the above. If the user picks the "neither" option or if the user does not respond at all within two minutes (as in the case of an unattended night batch) the program chains to CFA15.

To display the extra repeat positions report, the program simply reads the extra repeat positions data from the file CFA003 and prints it on the terminal.

To identify an extra repeat position the program asks for the wheel position of the repeat, the original wheel position of the sample, and the dilution information for the remeasured sample. It then changes the file CFA003 so that the records for the original sample contain the wheel position of the extra repeat position, and so that all of the baseline corrected peak heights are given a flag value less than -1000 to indicate "cannot be determined."

Finally, the program asks if the user wishes to deal with another sample. If not, the program chains to CFA15.

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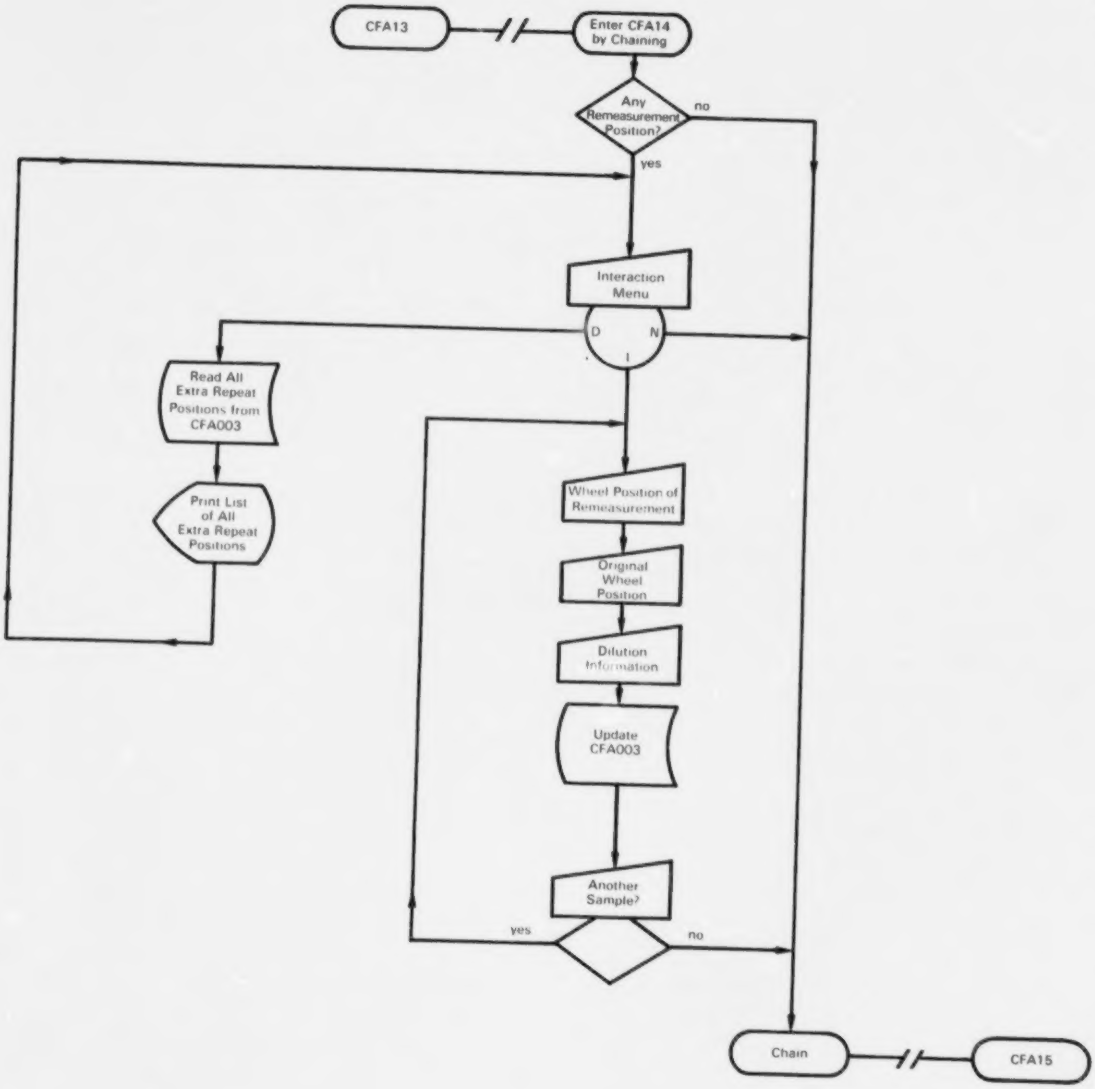
CFA13
Enter CFA14 by Chaining
Any Remeasurement Position?
no
yes
Interaction Menu
D
N
I
Read All Extra Repeat Positions from CFA003
Print List of All Extra Repeat Positions
Wheel Position of Remeasurement
Original Wheel Position
Dilution Information
Update CFA003
Another Sample?
yes
no
Chain
CFA15

Figure 20. Functional Flowchart for Program CFA14.

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TABLE 15. SYMBOL DEFINITIONS FOR CFA14

A$	the user's answer to several questions
A2$	the superstring of parameter-method codes
A3$	a general purpose string of formatted data
C()	the array of data common to all analytes for a wheel position; see symbol definitions for CFA03
E1	the wheel position of a remeasured sample
E2	the original wheel position of a remeasured sample
I	the control variable for loops
J	the control variable for loops
N	the number of analytes
O0	a wheel position being sent to the subroutine to be formatted
P0	the wheel position of the first remeasurement position
R9$	the name of the run file
S()	the array of data specific to one analyte for a wheel position; see symbol definitions for CFA03
V0	the volume of the sample
V1	the volume of the dilution water
W	the number of wheel positions occupied by the entire batch
W2	the number of positions in one wheel

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C-O-N-T-I-N-U-O-U-S  F-L-O-W  A-N-A-L-Y-Z-E-R  A-U-T-O  S-Y-S-T-E-M
5/23/1980                                                   PAGE  1
                     PROGRAM LISTING FOR CFA14

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
0010 REM   +=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+
0020 REM   +   CONTINUOUS FLOW ANALYZER AUTOMATION SYSTEM            +
0030 REM   +   PROGRAM CFA14, REPEAT POSITION IDENTIFIER             +
0040 REM   +   BY:  J. KOPKE (UCCC)     MARCH 10, 1980               +
0050 REM   +   MOST RECENT REVISION:  APRIL 15, 1980                 +
0060 REM   +=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+
0070 REM
0080 DIM A2$[21],A3$[79],C[4],R9$[13],S[14]
0090 ON ESC THEN GOTO 0120
0100 ESC
0110 GOTO 0150
0120 NOESC
0130 CLOSE
0140 CHAIN "CFA00"
0150 READ FILE[4,0],N,A2$,R9$,W,W2
0160 LET P0=0
0170 FOR I=W-2 TO 1 STEP -1
0180   READ FILE[4,(I-1)*(N+1)+1],C[1]
0190   IF C[1]<>9 THEN GOTO 0230
0200   IF P0<>0 THEN GOTO 0310
0210   NOESC
0220   CHAIN "CFA15"
0230   IF C[1]=10 THEN LET P0=I
0240 NEXT I
0250 PRINT
0260 PRINT "H = HELP"
0270 PRINT "D = DISPLAY EXTRA REPEAT POSITIONS REPORT"
0280 PRINT "I = IDENTIFY EXTRA REPEAT POSITIONS"
0290 PRINT "N = NEITHER OF THE ABOVE (THIS IS THE DEFAULT ANSWER IF TH
*    ERE IS"
0300 PRINT "         NO RESPONSE IN 2 MINUTES)"
0310 PRINT
0320 PRINT "EXTRA REPEAT POSITIONS INTERACTION ([H],D,I,N) >>  ";
0330 TIME =120
0340 ON ERR THEN GOTO 0380
0350 TINPUT "",A$
0360 ON ERR THEN STOP
0370 GOTO 0430
0380 ON ERR THEN STOP
0390 IF SYS(7)<>60 THEN GOTO 0430
0400 PRINT
0410 PRINT "NO RESPONSE IN 2 MINUTES HAS IMPLIED AN ANSWER OF 'N'"

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
```

```
C-O-N-T-I-N-U-O-U-S  F-L-O-W  A-N-A-L-Y-Z-E-R  A-U-T-O  S-Y-S-T-E-M
5/23/1980                                                   PAGE  2
                     PROGRAM LISTING FOR CFA14

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
0420 LET A$="N"
0430 IF A$="" THEN GOTO 0250
0440 IF A$="H" THEN GOTO 0250
0450 IF A$="D" THEN GOTO 0530
0460 IF A$="I" THEN GOTO 1000
0470 IF A$="N" THEN GOTO 1760
0480 PRINT
0490 PRINT "<7>INVALID RESPONSE"
0500 GOTO 0250
0510 REM  ------------------------------------------------------------
0520 REM          REMEASUREMENT POSITIONS REPORT
0530 FOR I=1 TO 5
0540   PRINT
0550 NEXT I
0560 PRINT "         E-X-T-R-A   R-E-P-E-A-T   P-O-S-I-T-I-O-N-S   R-E-
*    P-O-R-T"
0570 LET A3$="                                   DATE:  00/00/00"
0580 LET A3$[40-LEN(STR$(SYS(2))),39]=STR$(SYS(2))
0590 LET A3$[43-LEN(STR$(SYS(1))),42]=STR$(SYS(1))
0600 LET A3$[46-LEN(STR$(SYS(3)-1900)),45]=STR$(SYS(3)-1900)
0610 PRINT A3$
0620 PRINT
0630 LET A3$="  WHEEL        SAMPLE   DILUTION    "
0640 FOR I=1 TO N
0650   LET A3$=A3$,"    ",A2$[I*7-6,I*7]
0660 NEXT I
0670 PRINT A3$
0680 LET A3$=" POSITION       TYPE .   FACTOR     "
0690 FOR I=1 TO N
0700   LET A3$=A3$,"   RESULTS"
0710 NEXT I
0720 PRINT A3$
0730 LET A3$="----------  ----------  ------     "
0740 FOR I=1 TO N
0750   LET A3$=A3$,"  -------"
0760 NEXT I
0770 PRINT A3$
0780 FOR I=P0 TO W
0790   READ FILE[4,(I-1)*(N+1)+1],C[1]
0800   IF C[1]<>10 THEN GOTO 0940
0810   LET O0=I
0820   GOSUB 1800

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
```

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```
C-O-N-T-I-N-U-O-U-S  F-L-O-W  A-N-A-L-Y-Z-E-R  A-U-T-O  S-Y-S-T-E-M
5/23/1980                                                      PAGE  3
                       PROGRAM LISTING FOR CFA14

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
0830   LET A3$=A3$,"  REPEAT OF [ ]          BCPH:"
0840   PRINT A3$;
0850   FOR J=1 TO N
0860     MAT READ FILE[4,(I-1)*(N+1)+1+J],S
0870     IF S[1]>-1000 THEN GOTO 0900
0880     PRINT "        CBD ";
0890     GOTO 0910
0900     PRINT USING "------#.### ",S[2];
0910   NEXT J
0920   PRINT
0930 NEXT I
0940 FOR I=1 TO 5
0950   PRINT
0960 NEXT I
0970 GOTO 0310
0980 REM  ----------------------------------------------------------------
0990 REM         IDENTIFY REMEASURED SAMPLES
1000 PRINT
1010 ON ERR THEN GOTO 1030
1020 INPUT "WHEEL POSITION OF EXTRA REPEAT >>  ",E1
1030 ON ERR THEN STOP
1040 IF E1=INT(E1) THEN IF E1>0 THEN IF E1<=W THEN GOTO 1060
1050 GOTO 1080
1060 READ FILE[4,(E1-1)*(N+1)+1],C[1]
1070 IF C[1]=10 THEN GOTO 1110
1080 PRINT
1090 PRINT "<7>INVALID RESPONSE"
1100 GOTO 1000
1110 ON ERR THEN GOTO 1130
1120 INPUT "ORIGINAL WHEEL POSITION OF SAMPLE >>  ",E2
1130 ON ERR THEN STOP
1140 IF E2=INT(E2) THEN IF E2>0 THEN IF E2<=W THEN GOTO 1160
1150 GOTO 1180
1160 READ FILE[4,(E2-1)*(N+1)+1],C[1]
1170 IF INT(C[1])=3 THEN GOTO 1220
1180 PRINT
1190 PRINT "<7>INVALID RESPONSE"
1200 PRINT
1210 GOTO 1110
1220 PRINT "DILUTION INFORMATION:"
1230 ON ERR THEN GOTO 1250
1240 INPUT "     SAMPLE VOLUME IN ML >>  ",V0

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
```

```
C-O-N-T-I-N-U-O-U-S  F-L-O-W  A-N-A-L-Y-Z-E-R  A-U-T-O  S-Y-S-T-E-M
5/23/1980                                                      PAGE  4
                       PROGRAM LISTING FOR CFA14

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
1250 ON ERR THEN GOTO 1270
1260 INPUT "      DILUTION WATER VOLUME IN ML ([0],---) >>  ",A$
1270 ON ERR THEN STOP
1280 LET V1=0
1290 IF A$="" THEN GOTO 1330
1300 ON ERR THEN GOTO 1320
1310 LET V1=VAL(A$)
1320 ON ERR THEN STOP
1330 LET V0=V0/1000
1340 LET V1=V1/1000
1350 READ FILE[4,(E1-1)*(N+1)+1],C[1],C[2],C[3],C[4],S$
1360 LET C[2]=V0
1370 LET C[3]=V1
1380 LET C[4]=E2
1390 WRITE FILE[4,(E1-1)*(N+1)+1],C[1],C[2],C[3],C[4],S$
1400 READ FILE[4,(E2-1)*(N+1)+1],C[1],C[2],C[3],C[4],S$
1410 LET C[4]=E1
1420 WRITE FILE[4,(E2-1)*(N+1)+1],C[1],C[2],C[3],C[4],S$
1430 IF N<>1 THEN GOTO 1460
1440 LET I=1
1450 GOTO 1590
1460 PRINT "APPLICABLE ANALYTES:"
1470 FOR I=1 TO N
1480   PRINT "      ";A2$[I*7-6,I*7];
1490   ON ERR THEN GOTO 1510
1500   INPUT " ([N],Y) >>  ",A$
1510   ON ERR THEN STOP
1520   IF A$="" THEN GOTO 1630
1530   IF A$="N" THEN GOTO 1630
1540   IF A$="Y" THEN GOTO 1590
1550   PRINT
1560   PRINT "<7>     INVALID RESPONSE"
1570   PRINT
1580   GOTO 1480
1590   MAT READ FILE[4,(E2-1)*(N+1)+1+I],S
1600   LET S[2]=-66666
1610   MAT WRITE FILE[4,(E2-1)*(N+1)+1+I],S
1620   IF N=1 THEN GOTO 1640
1630 NEXT I
1640 PRINT
1650 ON ERR THEN GOTO 1670
1660 INPUT "ANOTHER SAMPLE ([N],Y) >>  ",A$

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
```

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(4-76)

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C-O-N-T-I-N-U-O-U-S   F-L-O-W   A-N-A-L-Y-Z-E-R   A-U-T-O   S-Y-S-T-E-M
5/23/1980                                                      PAGE  5
                      PROGRAM LISTING FOR CFA14

123456789112345678921234567893123456789412345678951234567896123456789 7
         0          0          0          0          0          0          0
1670 ON ERR THEN STOP
1680 IF A$="" THEN GOTO 1760
1690 IF A$="N" THEN GOTO 1760
1700 IF A$="Y" THEN GOTO 1000
1710 PRINT
1720 PRINT "<7>INVALID RESPONSE"
1730 GOTO 1640
1740 REM  -------------------------------------------------------------
1750 REM          WRAP-UP PROCEDURE
1760 NOESC
1770 CHAIN "CFA15"
1780 REM   +++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
1790 REM          SUBROUTINE TO FORMAT WHEEL POSITION
1800 LET A3$="000 (0/000)"
1810 LET A3$[4-LEN(STR$(O0)),3]=STR$(O0)
1820 LET A3$[6,6]=STR$(INT((O0-1)/W2)+1)
1830 LET A3$[11-LEN(STR$(O0-INT((O0-1)/W2)*W2)),10]=STR$(O0-INT((O0-1)
*     /W2)*W2)
1840 RETURN

123456789112345678921234567893123456789412345678951234567896123456789 7
         0          0          0          0          0          0          0
```

```
C-O-N-T-I-N-U-O-U-S   F-L-O-W   A-N-A-L-Y-Z-E-R   A-U-T-O   S-Y-S-T-E-M
5/23/1980                                                      PAGE  6
                        SYMBOL TABLE FOR CFA14

SYMBOL   REFERENCES
------  ------------------------------------------------------------------
 0120   0090
 0150   0110
 0230   0190
 0250   0430  0440  0500
 0310   0200  0970
 0380   0340
 0430   0370  0390
 0530   0450
 0900   0870
 0910   0890
 0940   0800
 1000   0460  1100  1700
 1030   1010
 1060   1040
 1080   1050
 1110   1070  1210
 1130   1110
 1160   1140
 1180   1150
 1220   1170
 1250   1230
 1270   1250
 1320   1300
 1330   1290
 1460   1430
 1480   1580
 1510   1490
 1590   1450  1540
 1630   1520  1530
 1640   1620  1730
 1670   1650
 1760   0470  1680  1690
 1800   0820
 A$     0350  0420  0430  0440  0450  0460  0470  1260  1290  1310
        1500  1520  1530  1540  1660  1680  1690  1700
 A2$    0080  0150  0650  1480
 A3$    0080  0570  0580  0590  0600  0610  0630  0650  0670  0680
        0700  0720  0730  0750  0770  0830  0840  1800  1810  1820
        1830
 C[     0080  0180  0190  0230  0790  0800  1060  1070  1160  1170
        1350  1360  1370  1380  1390  1400  1410  1420
 E1     1020  1040  1060  1350  1390  1410
 E2     1120  1140  1160  1380  1400  1420  1590  1610
 FL#4   0150  0180  0790  0860  1060  1160  1350  1390  1400  1420
        1590  1610
```

```
C-O-N-T-I-N-U-O-U-S   F-L-O-W   A-N-A-L-Y-Z-E-R   A-U-T-O   S-Y-S-T-E-M
5/23/1980                                                          PAGE  7
                           SYMBOL TABLE FOR CFA14

SYMBOL    REFERENCES
------   ----------------------------------------------------------------
  I       0170  0180  0230  0240  0530  0550  0640  0650  0660  0690
          0710  0740  0760  0780  0790  0810  0860  0930  0940  0960
          1440  1470  1480  1590  1610  1630
  J       0850  0860  0910
  N       0150  0180  0640  0690  0740  0790  0850  0860  1060  1160
          1350  1390  1400  1420  1430  1470  1590  1610  1620
  OO      0810  1810  1820  1830
  PO      0160  0200  0230  0780
  R9$     0080  0150
  S       0860  1590  1610
  S$      1350  1390  1400  1420
  S[      0080  0870  0900  1600
  VO      1240  1330  1360
  V1      1280  1310  1340  1370
  W       0150  0170  0780  1040  1140
  W2      0150  1820  1830
```

SECTION 17

PROGRAM CFA15 - FINAL REPORT PRINTER

CFA15 is the program which calculates the final results, taking into account all of the influences of baseline interpolation, recalibration, reagent blank subtraction, and extra repeat position identification. The program also prints the final report. CFA15 is entered by chaining from CFA14, and it chains back to CFA00 if the ESCAPE key is pressed.

The program first asks whether the user wants the final report printed on the lineprinter, the terminal, both, or neither. If the user does not answer at all within two minutes, as in the case of an unattended night batch, the program assumes that the final report should be printed on the lineprinter only.

If the user requests any form of final report, the program asks whether the extra detailed heading information should be included. If the user requests the extra heading information, the program also allows the user to add a comments line to that section of the final report.

Because the final results are calculated as the final report is assembled, the final report is prepared in file CFA000 even if the user does not want to see it at all. If the user requests the detailed heading information, all of the automation parameters and calibration equations are copied from file CFA004 to the report in file CFA000.

Then the calibration standards are copied from file CFA003 and put into order for interpolation purposes. The program then reads the sample data from CFA004 and branches to one of nine different routines, depending upon the sample type.

If the sample is a timing set standard or a blank, the program simply places the peak heights into the report in file CFA000.

If the sample is a calibration standard, the program places the baseline corrected peak heights and the theoretical concentrations into the report in file CFA000.

If the sample is an unknown or any type of repeat, the program places the baseline corrected peak heights and the calculated concentrations into the report in file CFA000.

If the sample is a spiked sample, the program places the baseline corrected peak heights, the measured concentrations of the spiked sample

(LSFs), the expected increases in concentration (LSAs), the percent recoveries, and the quality control evaluations into the report in file CFA000.

If the sample is a duplicate, the program places the baseline corrected peak heights, the measured concentrations (LD2s), the ranges, and the quality control evaluations into the report in file CFA000.

If the sample is a laboratory control standard, the program places the baseline corrected peak heights, the measured concentrations (LCMs), the theoretical concentrations (LCTs), into the report in file CFA000.

If the sample is a reagent blank, the program places the baseline corrected peak heights, the calculated concentrations, and the quality control evaluations into the report in file CFA000.

If the sample is a check standard, the program places the baseline corrected peak heights and the percent recoveries into the report in file CFA000.

When the report is complete, it is copied from file CFA000 to the terminal and/or the lineprinter, as originally requested by the user. The program then chains to CFA16.

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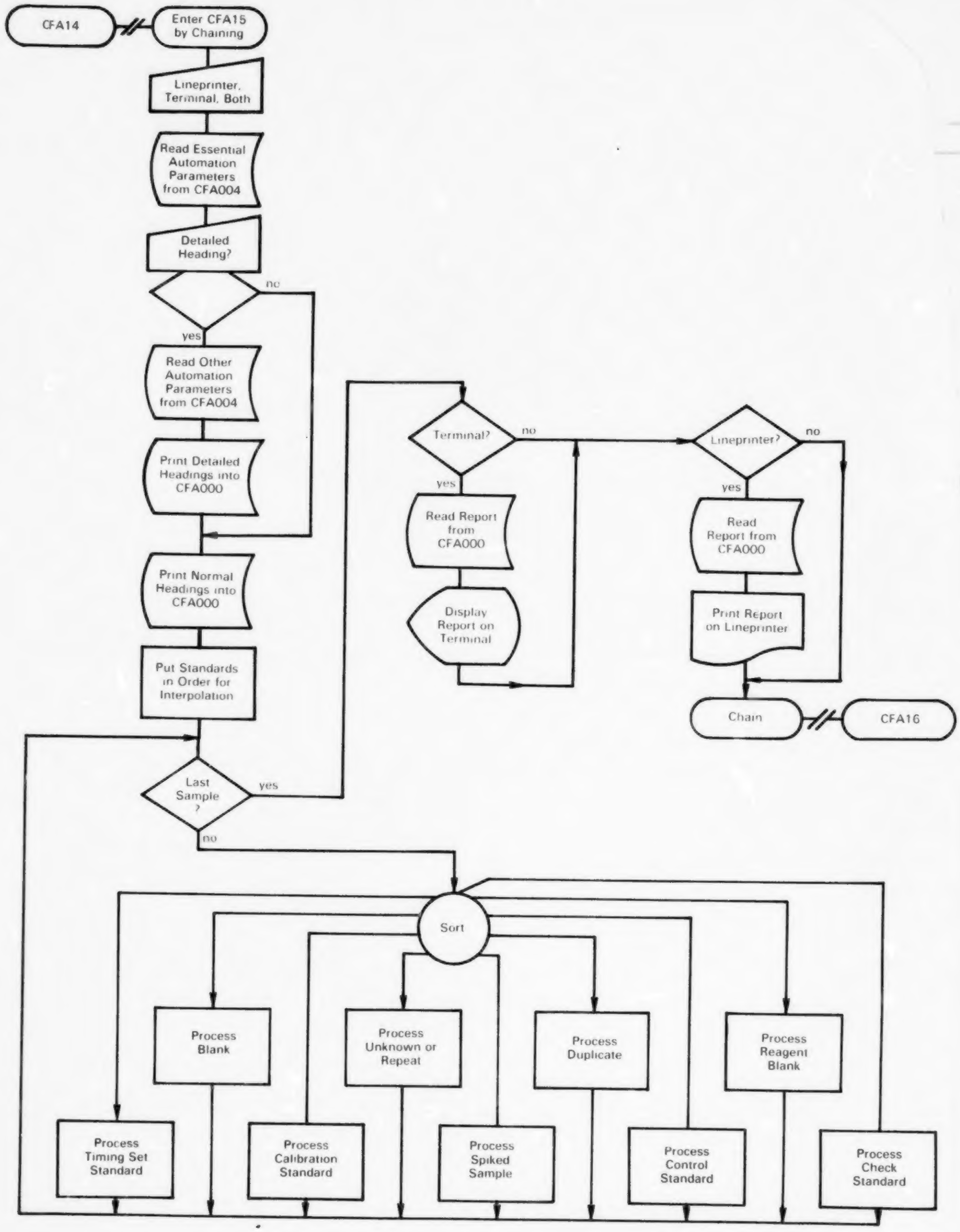
CFA14
Enter CFA15 by Chaining
Lineprinter, Terminal, Both
Read Essential Automation Parameters from CFA004
Detailed Heading?
no
yes
Read Other Automation Parameters from CFA004
Print Detailed Headings into CFA000
Print Normal Headings into CFA000
Put Standards in Order for Interpolation
Last Sample ?
yes
no
Terminal?
no
yes
Read Report from CFA000
Display Report on Terminal
Lineprinter?
no
yes
Read Report from CFA000
Print Report on Lineprinter
Chain
CFA16
Sort
Process Blank
Process Unknown or Repeat
Process Duplicate
Process Reagent Blank
Process Timing Set Standard
Process Calibration Standard
Process Spiked Sample
Process Control Standard
Process Check Standard

Figure 21. Functional Flowchart for Program CFA15.

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TABLE 16. SYMBOL DEFINITIONS FOR CFA15

A$	the user's answer to several questions
A2$	the superstring of parameter-method codes
A3$	a general purpose string of formatted data
A7	a flag for the mode of operation where 1 implies an attended run, and 0 implies an unattended run
A9$	the carriage return or semicolon after a string in a file
A9()	for spikes, the array of LSA values; for duplicates, the array of flags for quality control status, where 0 implies out of control, and 1 implies in control
B$	the user's answer to a question
C$	the comment string
C0	a counter for the number of good standards encountered
C()	the array of data common to all analytes for a wheel position; see symbol description for CFA03
D	the additional dilution factor for offscale samples
D2	the dilution factor
F6$	the format for printing automation parameters
F()	a general purpose array of automation parameters
G	a counter for the number of repeat positions which have been encountered
I	the control variable for loops
I3()	the array of allowable errors for check standards
I5()	the array of calibration standards for interpolation
I6()	the array of the coefficients of the calibration equations for all analytes
J	the control variable for loops
K	the control variable for loops
K5()	the array of degrees of fit
M()	the array of the coefficients for the calibration equation for one analyte
N	the number of analytes
P	the current sample wheel position
Q0	the sample type code
Q5	the volume of the original sample
Q6	the volume of the dilution water
Q7	the wheel position of the associated unknown
R9$	the name of the run file
R9()	for spikes and laboratory control standards, the array of percent recoveries; for duplicates, the array of ranges; for reagent blanks, the array of calculated concentrations
S$	the sample ID
S2()	the array of specific data for all of the analytes
S7()	the array of the numbers of calibration standards

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S()	the array of data specific to one analyte for a wheel position; see symbol definitions for CFA03
T4	the time between peaks
W	the number of wheel positions occupied by the entire batch
W5()	the array of detection limits
W6()	the array of offscale concentrations
X1	the peak height of the standard below a sample
X2	the peak height of the standard above a sample
X8	a counter for the number of lines printed on the lineprinter
Y1	the concentration of the standard below a sample
Y2	the concentration of the standard above a sample
Z3	a holding variable used in a sorting process
Z4	a holding variable used in a sorting process

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(4-76)

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C-O-N-T-I-N-U-O-U-S   F-L-O-W   A-N-A-L-Y-Z-E-R   A-U-T-O   S-Y-S-T-E-M
5/23/1980                                                          PAGE  1
                      PROGRAM LISTING FOR CFA15

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
0010 REM   +=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+
0020 REM   +   CONTINUOUS FLOW ANALYZER AUTOMATION SYSTEM                +
0030 REM   +   PROGRAM CFA15, FINAL REPORT PRINTER                       +
0040 REM   +   BY:  J. KOPKE (UCCC)     MARCH 17, 1980                   +
0050 REM   +   MOST RECENT REVISION:  APRIL 24, 1980                     +
0060 REM   +=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+
0070 REM
0080 ON ESC THEN GOTO 0110
0090 ESC
0100 GOTO 0140
0110 NOESC
0120 CLOSE
0130 CHAIN "CFA00"
0140 DIM A$[1],B$[1]
0150 LET G=0
0160 GOTO 0240
0170 PRINT
0180 PRINT "H = HELP"
0190 PRINT "L = LINEPRINTER (THIS IS THE DEFAULT ANSWER IF THERE IS NO
          "
0200 PRINT "            RESPONSE IN 2 MINUTES)"
0210 PRINT "T = TERMINAL"
0220 PRINT "B = BOTH LINEPRINTER AND TERMINAL"
0230 PRINT "N = NEITHER LINEPRINTER NOR TERMINAL"
0240 PRINT
0250 PRINT "FORM OF FINAL REPORT ([H],L,T,B,N) >>  ";
0260 TIME =120
0270 ON ERR THEN GOTO 0310
0280 TINPUT "",A$
0290 ON ERR THEN STOP
0300 GOTO 0360
0310 ON ERR THEN STOP
0320 IF SYS(7)<>60 THEN GOTO 0360
0330 PRINT "NO RESPONSE IN 2 MINUTES HAS IMPLIED AN ANSWER OF 'L'"
0340 LET A$="L"
0350 LET B$="Y"
0360 IF A$="" THEN GOTO 0170
0370 IF A$="H" THEN GOTO 0170
0380 IF A$="L" THEN GOTO 0450
0390 IF A$="T" THEN GOTO 0450
0400 IF A$="B" THEN GOTO 0450
0410 IF A$="N" THEN GOTO 0450

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
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C-O-N-T-I-N-U-O-U-S   F-L-O-W   A-N-A-L-Y-Z-E-R   A-U-T-O   S-Y-S-T-E-M
5/23/1980                                                          PAGE  2
                      PROGRAM LISTING FOR CFA15

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
0420 PRINT
0430 PRINT "<7>INVALID RESPONSE"
0440 GOTO 0170
0450 DIM A2$[21],R9$[13],C$[60],F6$[11],A9$[1]
0460 DIM S[14],C[4],A3$[79],M[4],U$[3]
0470 READ FILE[4,0],N,A2$,R9$,W,W2
0480 DIM K5[N],W5[N],W6[N],I3[N],S7[N]
0490 DIM I6[N,4],F[N],I5[2*N,20],S2[N,14],A9[N],R9[N]
0500 MAT READ FILE[5,8],K5
0510 MAT READ FILE[5,9],W5
0520 MAT READ FILE[5,10],W6
0530 MAT READ FILE[5,11],I3
0540 MAT READ FILE[5,22],S7
0550 FOR I=1 TO N
0560   MAT READ FILE[5,24+I],M
0570   FOR J=1 TO 4
0580     LET I6[I,J]=M[J]
0590   NEXT J
0600 NEXT I
0610 READ FILE[5,14],A7
0620 IF A$="N" THEN GOTO 0780
0630 IF B$<>"" THEN GOTO 0780
0640 PRINT
0650 ON ERR THEN GOTO 0670
0660 INPUT "DETAILED HEADING INFORMATION ([N],Y) >>  ",B$
0670 ON ERR THEN STOP
0680 IF B$="" THEN GOTO 0780
0690 IF B$="N" THEN GOTO 0780
0700 IF B$="Y" THEN GOTO 0740
0710 PRINT
0720 PRINT "<7>INVALID RESPONSE"
0730 GOTO 0640
0740 PRINT
0750 ON ERR THEN GOTO 0770
0760 INPUT "COMMENTS ([NONE],---) >>  ",C$
0770 ON ERR THEN STOP
0780 PRINT
0790 PRINT "THE FINAL RESULTS ARE BEING CALCULATED...";
0800 OPEN FILE[0,1],"CFA000"
0810 PRINT FILE[0],"                                  F-I-N-A-L   R-E-P-O-R-T"
0820 LET A3$="                                    DATE:  00/00/00"
0830 LET A3$[40-LEN(STR$(SYS(2))),39]=STR$(SYS(2))

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
```

```
C-O-N-T-I-N-U-O-U-S  F-L-O-W  A-N-A-L-Y-Z-E-R  A-U-T-O  S-Y-S-T-E-M
5/23/1980                                                     PAGE  3
                    PROGRAM LISTING FOR CFA15

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
0840 LET A3$[43-LEN(STR$(SYS(1))),42]=STR$(SYS(1))
0850 LET A3$[46-LEN(STR$(SYS(3)-1900)),45]=STR$(SYS(3)-1900)
0860 PRINT FILE[0],A3$
0870 PRINT FILE[0]
0880 REM   -----------------------------------------------------------
0890 REM            DETAILED HEADING INFORMATION
0900 IF B$<>"Y" THEN GOTO 1980
0910 IF C$="" THEN GOTO 0940
0920 LET A3$="COMMENTS:  ",C$
0930 PRINT FILE[0],A3$
0940 LET A3$="NAME OF RUN FILE:  "
0950 IF R9$="0000000.RF" THEN GOTO 0980
0960 LET A3$=A3$,R9$
0970 GOTO 0990
0980 LET A3$=A3$,"NON-SFC"
0990 PRINT FILE[0],A3$
1000 LET A3$="MODE OF OPERATION:  "
1010 IF A7=0 THEN LET A3$=A3$,"UN"
1020 LET A3$=A3$,"ATTENDED"
1030 PRINT FILE[0],A3$
1040 LET A3$="TIME BETWEEN PEAKS:  "
1050 READ FILE[5,1],T4,U$
1060 LET A3$=A3$,STR$(T4)," SECONDS"
1070 PRINT FILE[0],A3$
1080 LET A3$="ADDITIONAL DILUTION FACTOR FOR OFFSCALE SAMPLES:  "
1090 READ FILE[5,3],D
1100 IF D=0 THEN GOTO 1130
1110 LET A3$=A3$,STR$(D)
1120 GOTO 1140
1130 LET A3$=A3$,"VARIABLE"
1140 PRINT FILE[0],A3$
1150 PRINT FILE[0]
1160 LET A3$="                                        "
1170 FOR I=1 TO N
1180   LET A3$=A3$,"    ",A2$[I*7-6,I*7]
1190 NEXT I
1200 PRINT FILE[0],A3$
1210 LET A3$="                                        "
1220 FOR I=1 TO N
1230   LET A3$=A3$,"    VALUES"
1240 NEXT I
1250 PRINT FILE[0],A3$

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
```

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C-O-N-T-I-N-U-O-U-S  F-L-O-W  A-N-A-L-Y-Z-E-R  A-U-T-O  S-Y-S-T-E-M
5/23/1980                                                     PAGE  4
                    PROGRAM LISTING FOR CFA15

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
1260 LET A3$="                                        "
1270 FOR I=1 TO N
1280   LET A3$=A3$,"  --------"
1290 NEXT I
1300 PRINT FILE[0],A3$
1310 LET A3$="               DEFAULT CONCENTRATION UNIT:"
1320 FOR I=1 TO N
1330   IF U$[I,I]="M" THEN LET A3$=A3$,"     MG/L "
1340   IF U$[I,I]="U" THEN LET A3$=A3$,"     UG/L "
1350 NEXT I
1360 PRINT FILE[0],A3$
1370 LET A3$="                       A/D CHANNEL NUMBER:"
1380 MAT READ FILE[5,4],F
1390 LET F6$="    ##### "
1400 GOSUB 5180
1410 LET A3$="         SET STANDARD THRESHOLD HEIGHT:"
1420 MAT READ FILE[5,5],F
1430 GOSUB 5180
1440 LET A3$="         DATA ACQUISITION WINDOW WIDTH:"
1450 MAT READ FILE[5,6],F
1460 GOSUB 5180
1470 LET A3$="   STANDARD DEVIATION DEFINING LEVELNESS:"
1480 MAT READ FILE[5,7],F
1490 LET F6$="    ##.## "
1500 GOSUB 5180
1510 LET A3$="                          DETECTION LIMIT:"
1520 MAT F=W5
1530 LET F6$="-----#.### "
1540 GOSUB 5180
1550 LET A3$="                   OFFSCALE CONCENTRATION:"
1560 MAT F=W6
1570 GOSUB 5180
1580 LET A3$="    ALLOWABLE ERROR FOR CHECK STANDARDS:"
1590 MAT F=I3
1600 LET F6$=" ----#.##% "
1610 GOSUB 5180
1620 LET A3$="                              TYPE OF FIT:"
1630 MAT F=K5
1640 LET F6$="        # "
1650 GOSUB 5180
1660 LET A3$="               CALIBRATION FITTING ERROR:"
1670 MAT READ FILE[5,23],F

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
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C-O-N-T-I-N-U-O-U-S   F-L-O-W   A-N-A-L-Y-Z-E-R   A-U-T-O   S-Y-S-T-E-M
5/23/1980                                                          PAGE  5
                      PROGRAM LISTING FOR CFA15

 1234567891123456789212345678931234567894123456789512345678961234567897
          0         0         0         0         0         0         0
1680 LET F6$=" ----#.##% "
1690 GOSUB 5180
1700 LET A3$="               FORCED ORIGIN FITTING ERROR:"
1710 MAT READ FILE[5,24],F
1720 GOSUB 5180
1730 PRINT FILE[0]
1740 PRINT FILE[0],"CALIBRATION EQUATIONS:"
1750 FOR I=1 TO N
1760   LET A3$="      ",A2$[I*7-6,I*7],":  "
1770   IF K5[I]<>0 THEN GOTO 1810
1780   LET A3$=A3$,"INTERPOLATION"
1790   PRINT FILE[0],A3$
1800   GOTO 1900
1810   LET A3$=A3$,"CONC = +#.##^^^^  +#.##^^^^ *BCPH"
1820   IF K5[I]>1 THEN GOTO 1850
1830   PRINT FILE[0],USING A3$,I6[I,1],I6[I,2]
1840   GOTO 1900
1850   LET A3$=A3$,"  +#.##^^^^ *BCPH^2"
1860   PRINT FILE[0],USING A3$,I6[I,1],I6[I,2],I6[I,3]
1870   IF K5[I]<3 THEN GOTO 1900
1880   LET A3$="                        +#.##^^^^ *BCPH^3"
1890   PRINT FILE[0],USING A3$,I6[I,4]
1900 NEXT I
1910 PRINT FILE[0]
1920 PRINT FILE[0]
1930 PRINT FILE[0]
1940 PRINT FILE[0]
1950 PRINT ".";
1960 REM   ----------------------------------------------------------
1970 REM            NORMAL HEADINGS
1980 LET A3$="  WHEEL        SAMPLE    DILUTION     "
1990 FOR I=1 TO N
2000   LET A3$=A3$,"    ",A2$[I*7-6,I*7]
2010 NEXT I
2020 PRINT FILE[0],A3$
2030 LET A3$=" POSITION        TYPE      FACTOR     "
2040 FOR I=1 TO N
2050   LET A3$=A3$,"    RESULTS"
2060 NEXT I
2070 PRINT FILE[0],A3$
2080 LET A3$="----------  ----------  -------     "
2090 FOR I=1 TO N

 1234567891123456789212345678931234567894123456789512345678961234567897
          0         0         0         0         0         0         0
```

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C-O-N-T-I-N-U-O-U-S   F-L-O-W   A-N-A-L-Y-Z-E-R   A-U-T-O   S-Y-S-T-E-M
5/23/1980                                                          PAGE  6
                      PROGRAM LISTING FOR CFA15

 1234567891123456789212345678931234567894123456789512345678961234567897
          0         0         0         0         0         0         0
2100   LET A3$=A3$,"  --------"
2110 NEXT I
2120 PRINT FILE[0],A3$
2130 REM   ----------------------------------------------------------
2140 REM          PUT STANDARDS IN ORDER FOR INTERPOLATION
2150 FOR K=1 TO N
2160   LET CO=0
2170   FOR I=6 TO 30
2180     MAT READ FILE[4,(I-1)*(N+1)+1+K],S
2190     IF S[2]<-1000 THEN GOTO 2240
2200     LET CO=CO+1
2210     LET I5[2*K-1,CO]=S[2]
2220     LET I5[2*K,CO]=S[13]
2230     IF CO=S7[K] THEN GOTO 2250
2240   NEXT I
2250 NEXT K
2260 FOR I=1 TO N
2270   FOR J=S7[I] TO 2 STEP -1
2280     FOR K=2 TO J
2290       IF I5[2*I-1,K-1]<=I5[2*I-1,K] THEN GOTO 2360
2300       LET Z3=I5[2*I-1,K]
2310       LET Z4=I5[2*I,K]
2320       LET I5[2*I-1,K]=I5[2*I-1,K-1]
2330       LET I5[2*I,K]=I5[2*I,K-1]
2340       LET I5[2*I-1,K-1]=Z3
2350       LET I5[2*I,K-1]=Z4
2360     NEXT K
2370   NEXT J
2380 NEXT I
2390 PRINT ".";
2400 REM   ----------------------------------------------------------
2410 REM          SORT
2420 LET P=0
2430 LET P=P+1
2440 IF P>W THEN GOTO 4480
2450 IF P/10=INT(P/10) THEN PRINT ".";
2460 LET A3$="000 (0/000)  "
2470 LET A3$[4-LEN(STR$(P)),3]=STR$(P)
2480 LET A3$[6,6]=STR$(INT((P-1)/W2)+1)
2490 LET A3$[11-LEN(STR$(P-INT((P-1)/W2)*W2)),10]=STR$(P-INT((P-1)/W2)
*    *W2)
2500 READ FILE[4,(P-1)*(N+1)+1],C[1],C[2],C[3],C[4],S$

 1234567891123456789212345678931234567894123456789512345678961234567897
          0         0         0         0         0         0         0
```

PROGRAM LISTING FOR CFA15

```
12345678911234567892123456789312345678941234567895123456789612345678970
         0         0         0         0         0         0         0
2510 ON C[1] THEN GOTO 2540, 2660, 2740, 2960, 3450, 3930, 4170, 4310,
*     2600, 2740, 2740
2520 REM ---------------------------------------------------------------
2530 REM         TIMING SET STANDARD
2540 LET A3$=A3$,"SET STANDARD              PH:"
2550 PRINT FILE[0],A3$;
2560 GOSUB 5300
2570 GOTO 2430
2580 REM ---------------------------------------------------------------
2590 REM         BLANK
2600 LET A3$=A3$,"BLANK                     PH:"
2610 PRINT FILE[0],A3$;
2620 GOSUB 5300
2630 GOTO 2430
2640 REM ---------------------------------------------------------------
2650 REM         CALIBRATION STANDARD
2660 LET A3$=A3$,"CAL STANDARD            BCPH:"
2670 PRINT FILE[0],A3$;
2680 GOSUB 5410
2690 PRINT FILE[0],"                                    TCONC:";
2700 GOSUB 5850
2710 GOTO 2430
2720 REM ---------------------------------------------------------------
2730 REM         UNKNOWNS
2740 IF INT(C[1])=3 THEN GOTO 2800
2750 LET G=G+1
2760 IF G<>1 THEN GOTO 2800
2770 PRINT FILE[0]
2780 PRINT FILE[0],"THE FOLLOWING RESULTS ARE SIGNIFICANT ONLY AS INDI
*     CATED ABOVE:"
2790 PRINT FILE[0]
2800 LET D2=(C[2]+C[3])/C[2]
2810 IF INT(C[1])<>3 THEN GOTO 2850
2820 LET A3$=A3$,"ID: ########  ####.##  BCPH:"
2830 PRINT FILE[0],USING A3$,S$,D2;
2840 GOTO 2890
2850 LET A3$=A3$,"REPEAT OF 000 ####.##  BCPH:"
2860 LET A3$[27-LEN(STR$(C[4])),26]=STR$(C[4])
2870 IF A3$[24,26]="000" THEN LET A3$[24,26]="[ ]"
2880 PRINT FILE[0],USING A3$,D2;
2890 GOSUB 5410
2900 PRINT FILE[0],"                                     CONC:";

12345678911234567892123456789312345678941234567895123456789612345678970
         0         0         0         0         0         0         0
```

PROGRAM LISTING FOR CFA15

```
12345678911234567892123456789312345678941234567895123456789612345678970
         0         0         0         0         0         0         0
2910 GOSUB 5950
2920 GOSUB 6150
2930 GOTO 2430
2940 REM ---------------------------------------------------------------
2950 REM         SPIKED SAMPLE
2960 LET A3$=A3$,"SPIKE OF 000  ####.##  BCPH:"
2970 LET A3$[26-LEN(STR$(C[4])),25]=STR$(C[4])
2980 LET Q5=C[2]
2990 LET Q6=C[4]
3000 LET Q7=C[3]
3010 READ FILE[4,(Q6-1)*(N+1)+1],C[1],C[2],C[3],C[4],S$
3020 LET C[1]=4
3030 PRINT FILE[0],USING A3$,(C[2]+C[3])/C[2];
3040 GOSUB 5410
3050 LET D2=(C[2]+C[3]+Q5)/(C[2]+Q5)
3060 PRINT FILE[0],"                                      LSF:";
3070 GOSUB 5950
3080 FOR I=1 TO N
3090   MAT READ FILE[4,(Q6-1)*(N+1)+1+I],S
3100    IF Q5<>0 THEN GOTO 3130
3110   LET A9[I]=S2[I,13]/C[2]
3120    GOTO 3170
3130    IF S[12]>-1000 THEN IF S[12]>=W5[I] THEN IF S[12]<W6[I] THEN GO
*     TO 3160
3140   LET A9[I]=-99999
3150    GOTO 3170
3160   LET A9[I]=(S2[I,13]*Q5*C[2]-S[12]*C[2]*Q5-S[12]*Q5*C[3])/(C[2]*
*     C[2]+C[2]*Q5)
3170    IF S2[I,12]>-1000 THEN IF S2[I,12]>=W5[I] THEN IF S2[I,12]<W6[I
*     ] THEN GOTO 3190
3180    GOTO 3200
3190    IF S[12]>-1000 THEN IF S[12]>=W5[I] THEN IF S[12]<W6[I] THEN GO
*     TO 3220
3200   LET R9[I]=-99999
3210    GOTO 3230
3220   LET R9[I]=100*(S2[I,12]*D2-S[12]*(C[2]+C[3])/C[2])/A9[I]
3230 NEXT I
3240 PRINT FILE[0],"                                      LSA:";
3250 FOR I=1 TO N
3260    IF A9[I]<>-99999 THEN GOTO 3290
3270    PRINT FILE[0],"      CBD ";
3280    GOTO 3300

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         0         0         0         0         0         0         0
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*PA-287 (Cin.)
(4-75)

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C-O-N-T-I-N-U-O-U-S   F-L-O-W   A-N-A-L-Y-Z-E-R   A-U-T-O   S-Y-S-T-E-M
5/23/1980                                                         PAGE  9
                     PROGRAM LISTING FOR CFA15

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
3290   PRINT FILE[0],USING "------#.### ",A9[I];
3300 NEXT I
3310 PRINT FILE[0]
3320 PRINT FILE[0],"                                            RECV:";
3330 FOR I=1 TO N
3340   IF R9[I]<>-99999 THEN GOTO 3370
3350   PRINT FILE[0],"       CBD ";
3360   GOTO 3380
3370   PRINT FILE[0],USING " ----#.##% ",R9[I];
3380 NEXT I
3390 PRINT FILE[0]
3400 GOSUB 6150
3410 GOSUB 4940
3420 GOTO 2430
3430 REM    ----------------------------------------------------------
3440 REM              DUPLICATE
3450 LET A3$=A3$,"DUPE  OF 000  ####.##  BCPH:"
3460 LET A3$[26-LEN(STR$(C[4])),25]=STR$(C[4])
3470 LET Q0=C[1]
3480 LET Q6=C[4]
3490 READ FILE[4,(Q6-1)*(N+1)+1],C[1],C[2],C[3],C[4],S$
3500 LET C[1]=5
3510 LET D2=(C[2]+C[3])/C[2]
3520 PRINT FILE[0],USING A3$,D2;
3530 GOSUB 5410
3540 LET A3$="                                    LD#:"
3550 LET A3$[40,40]=STR$((Q0-4.99999)*10)
3560 PRINT FILE[0],A3$;
3570 GOSUB 5950
3580 FOR I=1 TO N
3590   MAT READ FILE[4,(Q6-1)*(N+1)+1+I],S
3600   IF S[12]>-1000 THEN IF S[12]>=W5[I] THEN IF S[12]<W6[I] THEN GO
*      TO 3620
3610   GOTO 3630
3620   IF S2[I,12]>-1000 THEN IF S2[I,12]>=W5[I] THEN IF S2[I,12]<W6[I
*      ] THEN GOTO 3660
3630   LET R9[I]=-99999
3640   LET A9[I]=-99999
3650   GOTO 3690
3660   LET R9[I]=ABS(S[12]*D2-S2[I,12]*D2)
3670   LET A9[I]=0
3680   IF R9[I]>S[10]*((S[12]*D2+S2[I,12]*D2)/2)+S[11] THEN LET A9[I]=
*      1

1234567891123456789212345678931234567894123456789512345678961234567897.
         0         0         0         0         0         0         0
```

```
C-O-N-T-I-N-U-O-U-S   F-L-O-W   A-N-A-L-Y-Z-E-R   A-U-T-O   S-Y-S-T-E-M
5/23/1980                                                         PAGE 10
                     PROGRAM LISTING FOR CFA15

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
3690 NEXT I
3700 PRINT FILE[0],"                                             RNG:";
3710 FOR I=1 TO N
3720   IF R9[I]<>-99999 THEN GOTO 3750
3730   PRINT FILE[0],"       CBD ";
3740   GOTO 3760
3750   PRINT FILE[0],USING "------#.### ",R9[I];
3760 NEXT I
3770 PRINT FILE[0]
3780 PRINT FILE[0],"                                              QC:";
3790 FOR I=1 TO N
3800   IF A9[I]<>-99999 THEN GOTO 3830
3810   PRINT FILE[0],"       CBD ";
3820   GOTO 3870
3830   IF A9[I]<>0 THEN GOTO 3860
3840   PRINT FILE[0],"        OK ";
3850   GOTO 3870
3860   PRINT FILE[0],"  UP CONT ";
3870 NEXT I
3880 PRINT FILE[0]
3890 GOSUB 6150
3900 GOTO 2430
3910 REM    -------------------------------------------------------------
3920 REM              LABORATORY CONTROL STANDARD
3930 LET A3$=A3$,"CONTROL STND          BCPH:"
3940 PRINT FILE[0],A3$;
3950 GOSUB 5410
3960 LET D2=1
3970 PRINT FILE[0],"                                             LCM:";
3980 GOSUB 5950
3990 PRINT FILE[0],"                                             LCT:";
4000 GOSUB 5850
4010 PRINT FILE[0],"                                            RECV:";
4020 FOR I=1 TO N
4030   IF S2[I,12]>-1000 THEN IF S2[I,12]>=W5[I] THEN IF S2[I,12]<W6[I
*      ] THEN GOTO 4070
4040   LET R9[I]=-99999
4050   PRINT FILE[0],"       CBD ";
4060   GOTO 4090
4070   LET R9[I]=100*S2[I,12]/S2[I,13]
4080   PRINT FILE[0],USING " ----#.##% ",R9[I];
4090 NEXT I

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
```

```
C-O-N-T-I-N-U-O-U-S   F-L-O-W   A-N-A-L-Y-Z-E-R   A-U-T-O   S-Y-S-T-E-M
5/23/1980                                                          PAGE 11
                        PROGRAM LISTING FOR CFA15

1234567891123456789212345678931234567894123456789512345678961234567897
         0          0          0          0          0          0      0
4100 PRINT FILE[0]
4110 LET Q6=P
4120 GOSUB 4940
4130 GOSUB 6150
4140 GOTO 2430
4150 REM    ------------------------------------------------------------
4160 REM          REAGENT BLANK
4170 LET A3$=A3$,"REAGENT BLNK          BCPH:"
4180 PRINT FILE[0],A3$;
4190 GOSUB 5410
4200 PRINT FILE[0],"                                        CONC:";
4210 GOSUB 5950
4220 FOR I=1 TO N
4230   LET R9[I]=S2[I,12]
4240 NEXT I
4250 LET Q6=P
4260 GOSUB 4940
4270 GOSUB 6150
4280 GOTO 2430
4290 REM    ------------------------------------------------------------
4300 REM          CHECK STANDARD
4310 LET A3$=A3$,"CHECK OF 000          BCPH:"
4320 LET A3$[26-LEN(STR$(C[4])),25]=STR$(C[4])
4330 PRINT FILE[0],A3$;
4340 GOSUB 5410
4350 PRINT FILE[0],"                                        RECV:";
4360 FOR I=1 TO N
4370   MAT READ FILE[4,(C[4]-1)*(N+1)+1+I],S
4380   IF S2[I,1]>-1000 THEN IF S[2]>-1000 THEN GOTO 4410
4390   PRINT FILE[0],"       CBD ";
4400   GOTO 4430
4410   LET R9[I]=100*S2[I,2]/S[2]
4420   PRINT FILE[0],USING " ---#.##% ",R9[I];
4430 NEXT I
4440 PRINT FILE[0]
4450 GOTO 2430
4460 REM    ------------------------------------------------------------
4470 REM          HARD COPY
4480 CLOSE FILE[0]
4490 PRINT
4500 IF A$<>"T" THEN IF A$<>"B" THEN GOTO 4630
4510 OPEN FILE[0,3],"CFA000"

1234567891123456789212345678931234567894123456789512345678961234567897
         0          0          0          0          0          0      0
```

```
C-O-N-T-I-N-U-O-U-S   F-L-O-W   A-N-A-L-Y-Z-E-R   A-U-T-O   S-Y-S-T-E-M
5/23/1980                                                          PAGE 12
                        PROGRAM LISTING FOR CFA15

1234567891123456789212345678931234567894123456789512345678961234567897
         0          0          0          0          0          0      0
4520 FOR I=1 TO 5
4530   PRINT
4540 NEXT I
4550 LREAD FILE[0],A3$,A9$
4560 IF EOF(0) THEN GOTO 4590
4570 PRINT A3$;A9$;
4580 GOTO 4550
4590 CLOSE FILE[0]
4600 FOR I=1 TO 5
4610   PRINT
4620 NEXT I
4630 IF A$<>"L" THEN IF A$<>"B" THEN GOTO 4890
4640 PRINT "THE REPORT IS BEING SENT TO THE LINEPRINTER...";
4650 OPEN FILE[0,3],"CFA000"
4660 ON ERR THEN GOTO 4700
4670 OPEN FILE[7,1],"$LPT"
4680 ON ERR THEN STOP
4690 GOTO 4750
4700 ON ERR THEN STOP
4710 PRINT
4720 PRINT "THE LINEPRINTER IS IN USE;  THERE WILL BE A 10-SECOND DELA
*    Y"
4730 DELAY =10
4740 GOTO 4660
4750 LET X8=0
4760 LREAD FILE[0],A3$,A9$
4770 iF EOF(0) THEN GOTO 4860
4780 IF A9$="<13>" THEN LET X8=X8+1
4790 LET A3$=A3$,A9$
4800 PRINT FILE[7],A3$;
4810 IF X8<>63 THEN GOTO 4760
4820 PRINT FILE[7],"<12>"
4830 LET X8=0
4840 PRINT ".";
4850 GOTO 4760
4860 CLOSE FILE[7]
4870 CLOSE FILE[0]
4880 PRINT
4890 NOESC
4900 WRITE FILE[4,0],N,A2$,R9$,W,W2,1
4910 CHAIN "CFA16"
4920 REM   ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

1234567891123456789212345678931234567894123456789512345678961234567897
         0          0          0          0          0          0      0
```

EPA-287 (Cin.)
(4-76)

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PROGRAM LISTING FOR CFA15

```
12345678911234567892123456789312345678941234567895123456789612345678970
         0         0         0         0         0         0         0
4930 REM             SUBROUTINE TO CHECK QC LIMITS
4940 PRINT FILE[0],"                                              QC:";
4950 FOR I=1 TO N
4960   IF R9[I]<>-99999 THEN GOTO 4990
4970   PRINT FILE[0],"       CBD ";
4980   GOTO 5130
4990   MAT READ FILE[4,(Q6-1)*(N+1)+1+I],S
5000   IF R9[I]<=S[3] THEN GOTO 5030
5010   PRINT FILE[0],"   UP CONT ";
5020   GOTO 5130
5030   IF R9[I]<=S[4] THEN GOTO 5060
5040   PRINT FILE[0],"   UP WARN ";
5050   GOTO 5130
5060   IF R9[I]>=S[7] THEN GOTO 5090
5070   PRINT FILE[0],"  LOW CONT ";
5080   GOTO 5130
5090   IF R9[I]>=S[6] THEN GOTO 5120
5100   PRINT FILE[0],"  LOW WARN ";
5110   GOTO 5130
5120   PRINT FILE[0],"        OK ";
5130 NEXT I
5140 PRINT FILE[0]
5150 RETURN
5160 REM    ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
5170 REM             SUBROUTINE TO FORMAT AUTOMATION PARAMETERS
5180 FOR I=1 TO N
5190   LET A3$=A3$,F6$
5200 NEXT I
5210 ON N THEN GOTO 5220, 5240, 5260
5220 PRINT FILE[0],USING A3$,F[1]
5230 GOTO 5270
5240 PRINT FILE[0],USING A3$,F[1],F[2]
5250 GOTO 5270
5260 PRINT FILE[0],USING A3$,F[1],F[2],F[3]
5270 RETURN
5280 REM    ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
5290 REM             SUBROUTINE TO DISPLAY PEAK HEIGHT
5300 FOR I=1 TO N
5310   MAT READ FILE[4,(P-1)*(N+1)+1+I],S
5320    IF S[1]<-1000 THEN GOTO 5350
5330   PRINT FILE[0],USING "-----#.### ",S[1];
5340   GOTO 5360

12345678911234567892123456789312345678941234567895123456789612345678970
         0         0         0         0         0         0         0
```

PROGRAM LISTING FOR CFA15

```
12345678911234567892123456789312345678941234567895123456789612345678970
         0         0         0         0         0         0         0
5350   PRINT FILE[0],"      CBD ";
5360 NEXT I
5370 PRINT FILE[0]
5380 RETURN
5390 REM    ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
5400 REM             SUBROUTINE TO FILL S2(), CALCULATE CONC, DISPLAY BCP
*    H
5410 FOR I=1 TO N
5420   MAT READ FILE[4,(P-1)*(N+1)+I+1],S
5430   FOR J=1 TO 14
5440     LET S2[I,J]=S[J]
5450   NEXT J
5460   IF S2[I,1]>-1000 THEN IF S2[I,2]>-1000 THEN GOTO 5490
5470   LET S2[I,12]=-99999
5480   GOTO 5660
5490   IF K5[I]=0 THEN GOTO 5520
5500   LET S2[I,12]=I6[I,1]+I6[I,2]*S2[I,2]+I6[I,3]*S2[I,2]^2+I6[I,4]*
*    S2[I,2]^3
5510   GOTO 5660
5520   IF S2[I,2]>I5[2*I-1,1] THEN GOTO 5580
5530   LET X1=0
5540   LET Y1=0
5550   LET X2=I5[2*I-1,1]
5560   LET Y2=I5[2*I,1]
5570   GOTO 5650
5580   FOR J=2 TO S7[I]
5590     IF S2[I,2]<=I5[2*I-1,J] THEN GOTO 5610
5600   NEXT J
5610   LET X1=I5[2*I-1,J-1]
5620   LET Y1=I5[2*I,J-1]
5630   LET X2=I5[2*I-1,J]
5640   LET Y2=I5[2*I,J]
5650   LET S2[I,12]=((Y2-Y1)/(X2-X1))*(S2[I,2]-X1)+Y1
5660   IF S2[I,12]=-99999 THEN GOTO 5700
5670   IF S2[I,12]>=W6[I] THEN IF INT(C[1])=3 THEN IF C[4]<>0 THEN GOT
*    0 5760
5680   PRINT FILE[0],USING "-----#.### ",S2[I,2];
5690   GOTO 5800
5700   IF INT(C[1])=3 THEN IF C[4]<>0 THEN GOTO 5760
5710   IF C[1]<>2 THEN GOTO 5740
5720   PRINT FILE[0],"   REMOVED ";
5730   GOTO 5800

12345678911234567892123456789312345678941234567895123456789612345678970
         0         0         0         0         0         0         0
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EPA-287 (Cin.)
(4-76)

```
C-O-N-T-I-N-U-O-U-S   F-L-O-W   A-N-A-L-Y-Z-E-R   A-U-T-O   S-Y-S-T-E-M
5/23/1980                                                           PAGE 15
                          PROGRAM LISTING FOR CFA15

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
5740    PRINT FILE[0],"       CBD ";
5750    GOTO 5800
5760    LET A3$="   SEE 000 "
5770    LET A3$[11-LEN(STR$(C[4])),10]=STR$(C[4])
5780    PRINT FILE[0],A3$;
5790    LET S2[I,12]=-88888
5800 NEXT I
5810 PRINT FILE[0]
5820 RETURN
5830 REM    ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
5840 REM            SUBROUTINE TO PRINT TCONC
5850 FOR I=1 TO N
5860    IF C[1]=2 THEN IF S2[I,2]<-1000 THEN GOTO 5890
5870    PRINT FILE[0],USING "-----#.### ",S2[I,13];
5880    GOTO 5900
5890    PRINT FILE[0],"           ";
5900 NEXT I
5910 PRINT FILE[0]
5920 RETURN
5930 REM    ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
5940 REM            SUBROUTINE TO PRINT CONC
5950 FOR I=1 TO N
5960    IF S2[I,12]<>-99999 THEN GOTO 5990
5970    PRINT FILE[0],"       CBD ";
5980    GOTO 6100
5990    IF S2[I,12]<>-88888 THEN GOTO 6020
6000    PRINT FILE[0],"           ";
6010    GOTO 6100
6020    IF S2[I,12]<W6[I] THEN GOTO 6050
6030    PRINT FILE[0]," OFFSCALE ";
6040    GOTO 6100
6050    IF S2[I,12]>=W5[I] THEN GOTO 6090
6060    IF C[1]=7 THEN GOTO 6090
6070    PRINT FILE[0],"       BDL ";
6080    GOTO 6100
6090    PRINT FILE[0],USING "-----#.### ",S2[I,12]*D2;
6100 NEXT I
6110 PRINT FILE[0]
6120 RETURN
6130 REM    ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
6140 REM            SUBROUTINE TO COPY S2() BACK INTO CFA003
6150 FOR I=1 TO N

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
```

```
C-O-N-T-I-N-U-O-U-S   F-L-O-W   A-N-A-L-Y-Z-E-R   A-U-T-O   S-Y-S-T-E-M
5/23/1980                                                           PAGE 16
                          PROGRAM LISTING FOR CFA15

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
6160    FOR J=1 TO 14
6170      LET S[J]=S2[I,J]
6180    NEXT J
6190    MAT WRITE FILE[4,(P-1)*(N+1)+1+I],S
6200 NEXT I
6210 RETURN

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
```

```
C-O-N-T-I-N-U-O-U-S   F-L-O-W   A-N-A-L-Y-Z-E-R   A-U-T-O   S-Y-S-T-E-M
5/23/1980                                                      PAGE 17
                         SYMBOL TABLE FOR CFA15

SYMBOL    REFERENCES
------    ------------------------------------------------------------

 0110   0080
 0140   0100
 0170   0360   0370   0440
 0240   0160
 0310   0270
 0360   0300   0320
 0450   0380   0390   0400   0410
 0640   0730
 0670   0650
 0740   0700
 0770   0750
 0780   0620   0630   0680   0690
 0940   0910
 0980   0950
 0990   0970
 1130   1100
 1140   1120
 1810   1770
 1850   1820
 1900   1800   1840   1870
 1980   0900
 2240   2190
 2250   2230
 2360   2290
 2430   2570   2630   2710   2930   3420   3900   4140   4280   4450
 2540   2510
 2600   2510
 2660   2510
 2740   2510
 2800   2740   2760
 2850   2810
 2890   2840
 2960   2510
 3130   3100
 3160   3130
 3170   3120   3150
 3190   3170
 3200   3180
 3220   3190
 3230   3210
 3290   3260
 3300   3280
 3370   3340
 3380   3360
 3450   2510
```

```
C-O-N-T-I-N-U-O-U-S   F-L-O-W   A-N-A-L-Y-Z-E-R   A-U-T-O   S-Y-S-T-E-M
5/23/1980                                                      PAGE 18
                         SYMBOL TABLE FOR CFA15

SYMBOL    REFERENCES
------    ------------------------------------------------------------

 3620   3600
 3630   3610
 3660   3620
 3690   3650
 3750   3720
 3760   3740
 3830   3800
 3860   3830
 3870   3820   3850
 3930   2510
 4070   4030
 4090   4060
 4170   2510
 4310   2510
 4410   4380
 4430   4400
 4480   2440
 4550   4580
 4590   4560
 4630   4500
 4660   4740
 4700   4660
 4750   4690
 4760   4810   4850
 4860   4770
 4890   4630
 4940   3410   4120   4260
 4990   4960
 5030   5000
 5060   5030
 5090   5060
 5120   5090
 5130   4980   5020   5050   5080   5110
 5180   1400   1430   1460   1500   1540   1570   1610   1650   1690   1720
 5220   5210
 5240   5210
 5260   5210
 5270   5230   5250
 5300   2560   2620
 5350   5320
 5360   5340
 5410   2680   2890   3040   3530   3950   4190   4340
 5490   5460
 5520   5490
 5580   5520
```

EPA-287 (Cin.)
(4-76)

```
C-O-N-T-I-N-U-O-U-S   F-L-O-W   A-N-A-L-Y-Z-E-R   A-U-T-O   S-Y-S-T-E-M
5/23/1980                                                         PAGE 19
                        SYMBOL TABLE FOR CFA15

SYMBOL    REFERENCES
------   ---------------------------------------------------------------
 5610    5590
 5650    5570
 5660    5480  5510
 5700    5660
 5740    5710
 5760    5670  5700
 5800    5690  5730  5750
 5850    2700  4000
 5890    5860
 5900    5880
 5950    2910  3070  3570  3980  4210
 5990    5960
 6020    5990
 6050    6020
 6090    6050  6060
 6100    5980  6010  6040  6080
 6150    2920  3400  3890  4130  4270
 A$      0140  0280  0340  0360  0370  0380  0390  0400  0410  0620
         4500  4630
 A2$     0450  0470  1180  1760  2000  4900
 A3$     0460  0820  0830  0840  0850  0860  0920  0930  0940  0960
         0980  0990  1000  1010  1020  1030  1040  1060  1070  1080
         1110  1130  1140  1160  1180  1200  1210  1230  1250  1260
         1280  1300  1310  1330  1340  1360  1370  1410  1440  1470
         1510  1550  1580  1620  1660  1700  1760  1780  1790  1810
         1830  1850  1860  1880  1890  1980  2000  2020  2030  2050
         2070  2080  2100  2120  2460  2470  2480  2490  2540  2550
         2600  2610  2660  2670  2820  2830  2850  2860  2870  2880
         2960  2970  3030  3450  3460  3520  3540  3550  3560  3930
         3940  4170  4180  4310  4320  4330  4550  4570  4760  4790
         4800  5190  5220  5240  5260  5760  5770  5780
 A7      0610  1010
 A9$     0450  4550  4570  4760  4780  4790
 A9[     0490  3110  3140  3160  3220  3260  3290  3640  3670  3680
         3800  3830
 B$      0140  0350  0630  0660  0680  0690  0700  0900
 C$      0450  0760  0910  0920
 CO      2160  2200  2210  2220  2230
 C[      0460  2500  2510  2740  2800  2810  2860  2970  2980  2990
         3000  3010  3020  3030  3050  3110  3160  3220  3460  3470
         3480  3490  3500  3510  4320  4370  5670  5700  5710  5770
         5860  6060
 D       1090  1100  1110
 D2      2800  2830  2880  3050  3220  3510  3520  3660  3680  3960
         6090
```

```
C-O-N-T-I-N-U-O-U-S   F-L-O-W   A-N-A-L-Y-Z-E-R   A-U-T-O   S-Y-S-T-E-M
5/23/1980                                                         PAGE 20
                        SYMBOL TABLE FOR CFA15

SYMBOL    REFERENCES
------   ---------------------------------------------------------------
 F       1380  1420  1450  1480  1520  1560  1590  1630  1670  1710
 F6$     0450  1390  1490  1530  1600  1640  1680  5190
 FL#0    0800  0810  0860  0870  0930  0990  1030  1070  1140  1150
         1200  1250  1300  1360  1730  1740  1790  1830  1860  1890
         1910  1920  1930  1940  2020  2070  2120  2550  2610  2670
         2690  2770  2780  2790  2830  2880  2900  3030  3060  3240
         3270  3290  3310  3320  3350  3370  3390  3520  3560  3700
         3730  3750  3770  3780  3810  3840  3860  3880  3940  3970
         3990  4010  4050  4080  4100  4180  4200  4330  4350  4390
         4420  4440  4480  4510  4550  4590  4650  4760  4870  4940
         4970  5010  5040  5070  5100  5120  5140  5220  5240  5260
         5330  5350  5370  5680  5720  5740  5780  5810  5870  5890
         5910  5970  6000  6030  6070  6090  6110
 FL#4    0470  2180  2500  3010  3090  3490  3590  4370  4900  4990
         5310  5420  6190
 FL#5    0500  0510  0520  0530  0540  0560  0610  1050  1090  1380
         1420  1450  1480  1670  1710
 FL#7    4670  4800  4820  4860
 F[      0490  5220  5240  5260
 G       0150  2750  2760
 I       0550  0560  0580  0600  1170  1180  1190  1220  1240  1270
         1290  1320  1330  1340  1350  1750  1760  1770  1820  1830
         1860  1870  1890  1900  1990  2000  2010  2040  2060  2090
         2110  2170  2180  2240  2260  2270  2290  2300  2310  2320
         2330  2340  2350  2380  3080  3090  3110  3130  3140  3160
         3170  3190  3200  3220  3230  3250  3260  3290  3300  3330
         3340  3370  3380  3580  3590  3600  3620  3630  3640  3660
         3670  3680  3690  3710  3720  3750  3760  3790  3800  3830
         3870  4020  4030  4040  4070  4080  4090  4220  4230  4240
         4360  4370  4380  4410  4420  4430  4520  4540  4600  4620
         4950  4960  4990  5000  5030  5060  5090  5130  5180  5200
         5300  5310  5360  5410  5420  5440  5460  5470  5490  5500
         5520  5550  5560  5580  5590  5610  5620  5630  5640  5650
         5660  5670  5680  5790  5800  5850  5860  5870  5900  5950
         5960  5990  6020  6050  6090  6100  6150  6170  6190  6200
 I3      0530  1590
 I3[     0480
 I5[     0490  2210  2220  2290  2300  2310  2320  2330  2340  2350
         5520  5550  5560  5590  5610  5620  5630  5640
 I6[     0490  0580  1830  1860  1890  5500
 J       0570  0580  0590  2270  2280  2370  5430  5440  5450  5580
         5590  5600  5610  5620  5630  5640  6160  6170  6180
 K       2150  2180  2210  2220  2230  2250  2280  2290  2300  2310
         2320  2330  2340  2350  2360
 K5      0500  1630
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EPA-287 (Cin.)
(4-76)

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EPA-287 (Cin.)
(4-76)

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C-O-N-T-I-N-U-O-U-S   F-L-O-W   A-N-A-L-Y-Z-E-R   A-U-T-O   S-Y-S-T-E-M
5/23/1980                                                          PAGE 21
                          SYMBOL TABLE FOR CFA15

SYMBOL    REFERENCES
------   ---------------------------------------------------------------

 K5[     0480  1770  1820  1870  5490
 M       0560
 M[      0460  0580
 N       0470  0480  0490  0550  1170  1220  1270  1320  1750  1990
         2040  2090  2150  2180  2260  2500  3010  3080  3090  3250
         3330  3490  3580  3590  3710  3790  4020  4220  4360  4370
         4900  4950  4990  5180  5210  5300  5310  5410  5420  5850
         5950  6150  6190
 P       2420  2430  2440  2450  2470  2480  2490  2500  4110  4250
         5310  5420  6190
 Q0      3470  3550
 Q5      2980  3050  3100  3160
 Q6      2990  3010  3090  3480  3490  3590  4110  4250  4990
 Q7      3000
 R9$     0450  0470  0950  0960  4900
 R9[     0490  3200  3220  3340  3370  3630  3660  3680  3720  3750
         4040  4070  4080  4230  4410  4420  4960  5000  5030  5060
         5090
 S       2180  3090  3590  4370  4990  5310  5420  6190
 S$      2500  2830  3010  3490
 S2[     0490  3110  3160  3170  3220  3620  3660  3680  4030  4070
         4230  4380  4410  5440  5460  5470  5500  5520  5590  5650
         5660  5670  5680  5790  5860  5870  5960  5990  6020  6050
         6090  6170
 S7      0540
 S7[     0480  2230  2270  5580
 S[      0460  2190  2210  2220  3130  3160  3190  3220  3600  3660
         3680  4380  4410  5000  5030  5060  5090  5320  5330  5440
         6170
 T4      1050  1060
 U$      0460  1050  1330  1340
 W       0470  2440  4900
 W2      0470  2480  2490  4900
 W5      0510  1520
 W5[     0480  3130  3170  3190  3600  3620  4030  6050
 W6      0520  1560
 W6[     0480  3130  3170  3190  3600  3620  4030  5670  6020
 X1      5530  5610  5650
 X2      5550  5630  5650
 X8      4750  4780  4810  4830
 Y1      5540  5620  5650
 Y2      5560  5640  5650
 Z3      2300  2340
 Z4      2310  2350
```

SECTION 18

PROGRAM CFA16 - SUBTRACTED RESULTS REPORTER

CFA16 is the program which prepares the subtracted results report. It is entered by chaining from program CFA15, and it chains back to program CFA00 if the ESCAPE key is pressed.

The first function of CFA16 is to check the subtracted results report flag in file CFA004. If this flag is a zero, the user does not want any subtracted results report, and therefore the program chains directly to program CFA17.

If the flag is not a zero, the program asks the user whether the report should be printed on the lineprinter, the terminal, both, or neither. If the user opts for neither, this program chains directly to program CFA17. If the user does not respond to this question at all within two minutes, the program assumes that the report is to be sent to the lineprinter.

The report is always prepared in file CFA000 and copied later to the lineprinter and/or the terminal. The report is prepared for the two analytes specified in file CFA004. The heading information for the report is placed into file CFA000 first.

Then the program reads through file CFA003, ignoring all samples except for unknowns and repeat positions. For the relevant samples, the program places their calculated concentrations and the differences between their calculated concentrations into the report in file CFA000. If either of the concentrations is offscale or cannot be determined, the program marks the difference between the two concentrations as "cannot be determined." However, if either or both of the analytes have an associated repeat position, the program will look there for a usable concentration before resorting to the "cannot be determined" label. For the repeat positions themselves, the program does not attempt to calculate a subtracted result.

When the report is complete in file CFA000, the program copies it to the terminal and/or the lineprinter, as instructed by the user at the beginning of the program. Finally, this program chains to CFA17.

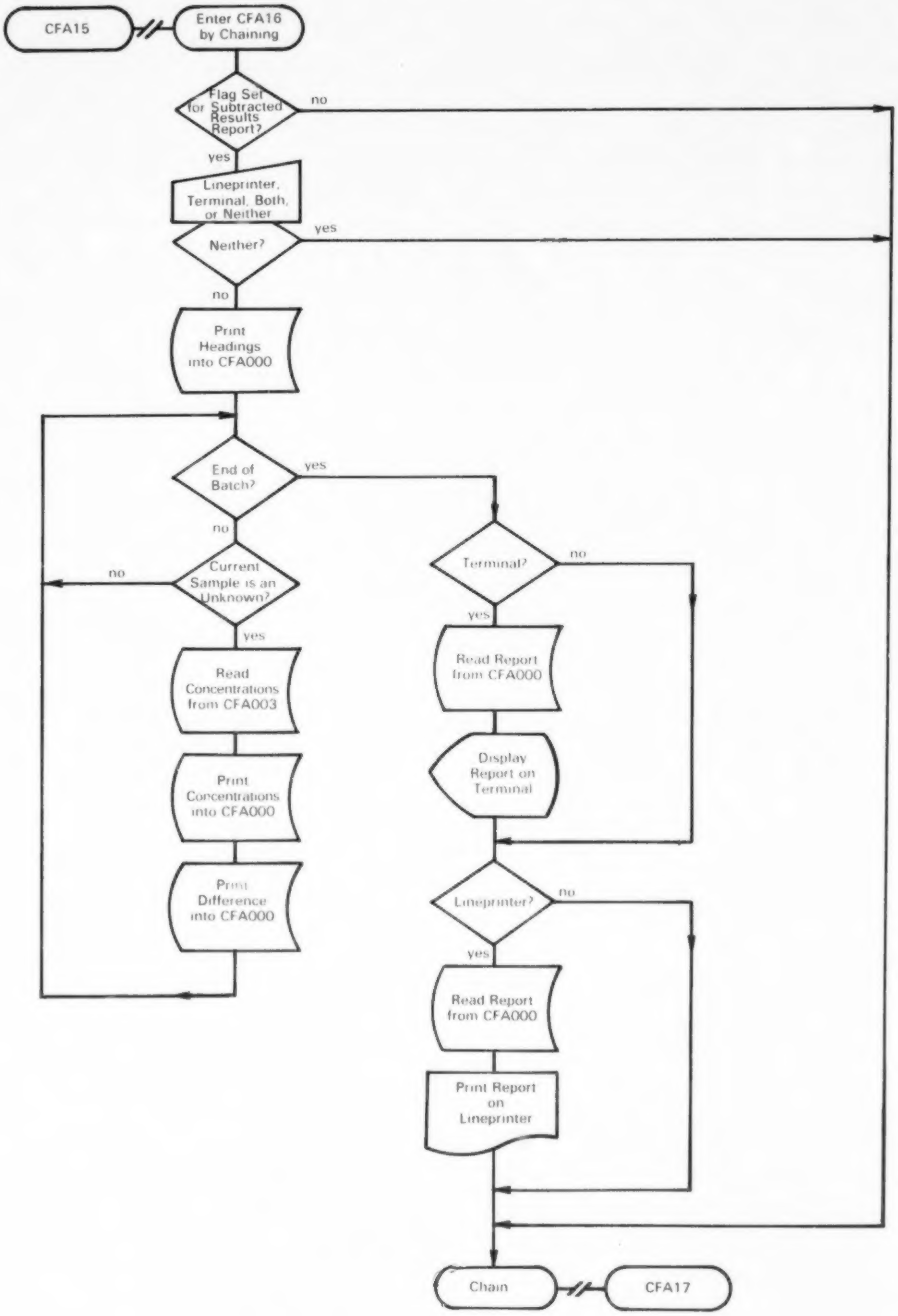
CFA15
Enter CFA16 by Chaining
Flag Set for Subtracted Results Report?
no
yes
Lineprinter, Terminal, Both, or Neither
Neither?
yes
no
Print Headings into CFA000
End of Batch?
yes
no
Current Sample is an Unknown?
no
yes
Read Concentrations from CFA003
Print Concentrations into CFA000
Print Difference into CFA000
Terminal?
no
yes
Read Report from CFA000
Display Report on Terminal
Lineprinter?
no
yes
Read Report from CFA000
Print Report on Lineprinter
Chain
CFA17

Figure 22 Functional Flowchart for Program CFA16

TABLE 17. SYMBOL DEFINITIONS FOR CFA16

A$	the user's answer to a question
A2$	the superstring of parameter-method codes
A3$	a general purpose string of formatted data
A9$	the carriage return or semicolon of a line read from a file
C9()	the two calculated concentrations to be subracted
C()	the array of data common to all analytes for a wheel position; see symbol definitions for CFA03
D2	the dilution factor
G	a counter for the number of repeat positions
I	the control variable for loops
I9	the analyte under consideration
N	the number of analytes
P	the wheel position of the current sample
Q5	the volume of the original sample
Q6	the volume of the dilution water
Q7	a dummy variable
R6	a flag for which a value of 1 implies that a subtracted results report should be prepared, and a value of 0 implies that it should not
R7	the position in A2$ of the minuend analyte
R8	the position in A2$ of the subtrahend analyte
R9$	the name of the run file
S$	the sample ID
S2()	the array of the data specific to both of the analytes for a wheel position
S()	the array of data specific to one analyte for a wheel position; see symbol definitions for CFA03
W	the number of wheel positions occupied by the batch
W2	the number of positions in one sample wheel
W5()	the array of detection limits
W6()	the array of offscale concentrations
X8	a counter for the number of lines printed on the lineprinter

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```
C-O-N-T-I-N-U-O-U-S  F-L-O-W · A-N-A-L-Y-Z-E-R  A-U-T-O  S-Y-S-T-E-M
5/23/1980                                                     PAGE  1
                    PROGRAM LISTING FOR CFA16

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
0010 REM   +=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+
0020 REM   +   CONTINUOUS FLOW ANALYZER AUTOMATION SYSTEM             +
0030 REM   +   PROGRAM CFA16, SUBTRACTED RESULTS REPORTER             +
0040 REM   +   BY:  J. KOPKE (UCCC)      MARCH 18, 1980               +
0050 REM   +   MOST RECENT REVISION:  APRIL 14, 1980                  +
0060 REM   +=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+
0070 REM
0080 DIM A$[1]
0090 ON ESC THEN GOTO 0120
0100 ESC
0110 GOTO 0150
0120 NOESC
0130 CLOSE
0140 CHAIN "CFA00"
0150 READ FILE[5,2],R6,R7,R8
0160 IF R6<>0 THEN GOTO 0270
0170 NOESC
0180 CLOSE
0190 CHAIN "CFA17"
0200 PRINT
0210 PRINT "H = HELP"
0220 PRINT "L = LINEPRINTER (THIS IS THE DEFAULT ANSWER IF THERE IS NO
*    "
0230 PRINT "          RESPONSE IN 2 MINUTES)"
0240 PRINT "T = TERMINAL"
0250 PRINT "B = BOTH LINEPRINTER AND TERMINAL"
0260 PRINT "N = NEITHER LINEPRINTER NOR TERMINAL"
0270 PRINT
0280 PRINT "FORM OF SUBTRACTED RESULTS REPORT ([H],L,T,B,N) >>  ";
0290 TIME =120
0300 ON ERR THEN GOTO 0340
0310 TINPUT "",A$
0320 ON ERR THEN STOP
0330 GOTO 0390
0340 ON ERR THEN STOP
0350 IF SYS(7)<>60 THEN GOTO 0390
0360 PRINT
0370 PRINT "NO RESPONSE IN 2 MINUTES HAS IMPLIED AN ANSWER OF 'L'"
0380 LET A$="L"
0390 IF A$="" THEN GOTO 0200
0400 IF A$="H" THEN GOTO 0220
0410 IF A$="L" THEN GOTO 0500

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
```

```
C-O-N-T-I-N-U-O-U-S  F-L-O-W  A-N-A-L-Y-Z-E-R  A-U-T-O  S-Y-S-T-E-M
5/23/1980                                                     PAGE  2
                    PROGRAM LISTING FOR CFA16

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
0420 IF A$="T" THEN GOTO 0500
0430 IF A$="B" THEN GOTO 0500
0440 IF A$="N" THEN GOTO 0170
0450 PRINT
0460 PRINT "<7>INVALID RESPONSE"
0470 GOTO 0200
0480 REM   ------------------------------------------------------------
0490 REM          HEADINGS
0500 PRINT
0510 PRINT "THE REPORT IS BEING PREPARED...";
0520 DIM A2$[21],R9$[79],C[4],S$[8],S[14],S2[2,14],C9[2],A9$[1],A3$[79
*    ]
0530 READ FILE[4,0],N,A2$,R9$,W,W2
0540 DIM W5[N],W6[N]
0550 MAT READ FILE[5,9],W5
0560 MAT READ FILE[5,10],W6
0570 OPEN FILE[0,1],"CFA000"
0580 PRINT FILE[0],"               S-U-B-T-R-A-C-T-E-D  R-E-S-U-L-T-S
*    R-E-P-O-R-T"
0590 LET A3$="                                DATE:  00/00/00"
0600 LET A3$[40-LEN(STR$(SYS(2))),39]=STR$(SYS(2))
0610 LET A3$[43-LEN(STR$(SYS(1))),42]=STR$(SYS(1))
0620 LET A3$[46-LEN(STR$(SYS(3)-1900)),45]=STR$(SYS(3)-1900)
0630 PRINT FILE[0],A3$
0640 PRINT FILE[0]
0650 PRINT FILE[0],"  WHEEL       SAMPLE     DILUTION          ";A2$[R
*    7*7-6,R7*7];"    ";A2$[R8*7-6,R8*7];"    DIFFER-"
0660 PRINT FILE[0]," POSITION        TYPE       FACTOR           RESULTS
*        RESULTS      ENCE"
0670 PRINT FILE[0],"--------  ---------  -----            -----
*    -  -------   -------"
0680 REM   ------------------------------------------------------------
0690 REM          PREPARE REPORT
0700 LET G=0
0710 LET P=0
0720 LET P=P+1
0730 IF P>W THEN GOTO 1490
0740 IF P/10=INT(P/10) THEN PRINT ".";
0750 READ FILE[4,(P-1)*(N+1)+1],C[1],C[2],C[3],C[4],S$
0760 IF INT(C[1])=3 THEN GOTO 0850
0770 IF C[1]=10 THEN GOTO 0800
0780 IF C[1]=11 THEN GOTO 0800

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
```

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(4-75)

PROGRAM LISTING FOR CFA16

```
 12345678911234567892123456789312345678941234567895123456789612345678970
          0          0          0          0          0          0          0
 0790 GOTO 0720
 0800 LET G=G+1
 0810 IF G<>1 THEN GOTO 0850
 0820 PRINT FILE[0]
 0830 PRINT FILE[0],"THE FOLLOWING RESULTS ARE SIGNIFICANT ONLY AS INDI
*     CATED ABOVE:"
 0840 PRINT FILE[0]
 0850 LET A3$="000 (0/000)  "
 0860 LET A3$[4-LEN(STR$(P)),3]=STR$(P)
 0870 LET A3$[6,6]=STR$(INT((P-1)/W2)+1)
 0880 LET A3$[11-LEN(STR$(P-INT((P-1)/W2)*W2)),10]=STR$(P-INT((P-1)/W2)
*     *W2)
 0890 LET D2=(C[2]+C[3])/C[2]
 0900 IF INT(C[1])<>3 THEN GOTO 0940
 0910 LET A3$=A3$,"ID: ########  ####.##  CONC:"
 0920 PRINT FILE[0],USING A3$,S$,D2;
 0930 GOTO 0980
 0940 LET A3$=A3$,"REPEAT OF 000 ####.##  CONC:"
 0950 LET A3$[27-LEN(STR$(C[4])),26]=STR$(C[4])
 0960 IF A3$[24,26]="000" THEN LET A3$[24,26]="[ ]"
 0970 PRINT FILE[0],USING A3$,D2;
 0980 MAT READ FILE[4,(P-1)*(N+1)+1+R7],S
 0990 FOR I=1 TO 14
 1000   LET S2[1,I]=S[I]
 1010 NEXT I
 1020 MAT READ FILE[4,(P-1)*(N+1)+1+R8],S
 1030 FOR I=1 TO 14
 1040   LET S2[2,I]=S[I]
 1050 NEXT I
 1060 FOR I=1 TO 2
 1070   LET I9=R7
 1080   IF I=2 THEN LET I9=R8
 1090   IF S2[I,12]<>-99999 THEN GOTO 1130
 1100   PRINT FILE[0],"      CBD ";
 1110   LET C9[I]=-99999
 1120   GOTO 1380
 1130   IF S2[I,12]<>-88888 THEN GOTO 1270
 1140   LET A3$="   SEE 000 "
 1150   LET A3$[11-LEN(STR$(C[4])),10]=STR$(C[4])
 1160   PRINT FILE[0],A3$;
 1170   READ FILE[4,(C[4]-1)*(N+1)+1],Q7,Q5,Q6
 1180    IF I=2 THEN GOTO 1210

 12345678911234567892123456789312345678941234567895123456789612345678970
          0          0          0          0          0          0          0
```

PROGRAM LISTING FOR CFA16

```
 12345678911234567892123456789312345678941234567895123456789612345678970
          0          0          0          0          0          0          0
 1190   MAT READ FILE[4,(C[4]-1)*(N+1)+1+R7],S
 1200   GOTO 1220
 1210   MAT READ FILE[4,(C[4]-1)*(N+1)+1+R8],S
 1220   IF S[12]>-1000 THEN IF S[12]<W6[I9] THEN IF S[12]>=W5[I9] THEN
*     GOTO 1250
 1230   LET C9[I]=-99999
 1240   GOTO 1380
 1250   LET C9[I]=S[12]*(Q5+Q6)/Q5
 1260   GOTO 1380
 1270   IF S2[I,12]<W6[I9] THEN GOTO 1310
 1280   PRINT FILE[0],"  OFFSCALE ";
 1290   LET C9[I]=-99999
 1300   GOTO 1380
 1310   IF S2[I,12]>=W5[I9] THEN GOTO 1360
 1320   PRINT FILE[0],"       BDL ";
 1330   LET C9[I]=-99999
 1340   IF I=2 THEN LET C9[I]=0
 1350   GOTO 1380
 1360   LET C9[I]=S2[I,12]*D2
 1370   PRINT FILE[0],USING "-----#.### ",C9[I];
 1380 NEXT I
 1390 IF INT(C[1])=3 THEN GOTO 1420
 1400 PRINT FILE[0]
 1410 GOTO 0720
 1420 IF C9[1]<>-99999 THEN IF C9[2]<>-99999 THEN GOTO 1450
 1430 PRINT FILE[0],"       CBD"
 1440 GOTO 0720
 1450 PRINT FILE[0],USING "-----#.###",C9[1]-C9[2]
 1460 GOTO 0720
 1470 REM   -------------------------------------------------------------
 1480 REM           HARD COPY
 1490 CLOSE FILE[0]
 1500 PRINT
 1510 IF A$<>"T" THEN IF A$<>"B" THEN GOTO 1640
 1520 OPEN FILE[0,3],"CFA000"
 1530 FOR I=1 TO 5
 1540   PRINT
 1550 NEXT I
 1560 LREAD FILE[0],A3$,A9$
 1570 IF EOF(0) THEN GOTO 1600
 1580 PRINT A3$;A9$;
 1590 GOTO 1560

 12345678911234567892123456789312345678941234567895123456789612345678970
          0          0          0          0          0          0          0
```

```
C-O-N-T-I-N-U-O-U-S   F-L-O-W   A-N-A-L-Y-Z-E-R   A-U-T-O   S-Y-S-T-E-M
5/23/1980                                                      PAGE  5
                       PROGRAM LISTING FOR CFA16

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
1600 CLOSE FILE[0]
1610 FOR I=1 TO 5
1620   PRINT
1630 NEXT I
1640 IF A$<>"L" THEN IF A$<>"B" THEN GOTO 1900
1650 PRINT "THE REPORT IS BEING SENT TO THE LINEPRINTER...";
1660 OPEN FILE[0,3],"CFA000"
1670 ON ERR THEN GOTO 1710
1680 OPEN FILE[7,1],"$LPT"
1690 ON ERR THEN STOP
1700 GOTO 1760
1710 ON ERR THEN STOP
1720 PRINT
1730 PRINT "THE LINEPRINTER IS IN USE;  THERE WILL BE A 10-SECOND DELA
*    Y"
1740 DELAY =10
1750 GOTO 1670
1760 LET X8=0
1770 PRINT ".";
1780 LREAD FILE[0],A3$,A9$
1790 IF EOF(0) THEN GOTO 1870
1800 IF A9$="<13>" THEN LET X8=X8+1
1810 LET A3$=A3$,A9$
1820 PRINT FILE[7],A3$;
1830 IF X8<>63 THEN GOTO 1780
1840 PRINT FILE[7],"<12>"
1850 LET X8=0
1860 GOTO 1780
1870 CLOSE FILE[7]
1880 CLOSE FILE[0]
1890 PRINT
1900 NOESC
1910 CLOSE
1920 CHAIN "CFA17"





1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
```

```
C-O-N-T-I-N-U-O-U-S   F-L-O-W   A-N-A-L-Y-Z-E-R   A-U-T-O   S-Y-S-T-E-M
5/23/1980                                                      PAGE  6
                          SYMBOL TABLE FOR CFA16

SYMBOL   REFERENCES
------   ---------------------------------------------------------------
0120     0090
0150     0110
0170     0440
0200     0390  0470
0220     0400
0270     0160
0340     0300
0390     0330  0350
0500     0410  0420  0430
0720     0790  1410  1440  1460
0800     0770  0780
0850     0760  0810
0940     0900
0980     0930
1130     1090
1210     1180
1220     1200
1250     1220
1270     1130
1310     1270
1360     1310
1380     1120  1240  1260  1300  1350
1420     1390
1450     1420
1490     0730
1560     1590
1600     1570
1640     1510
1670     1750
1710     1670
1760     1700
1780     1830  1860
1870     1790
1900     1640
A$       0080  0310  0380  0390  0400  0410  0420  0430  0440  1510
         1640
A2$      0520  0530  0650
A3$      0520  0590  0600  0610  0620  0630  0850  0860  0870  0880
         0910  0920  0940  0950  0960  0970  1140  1150  1160  1560
         1580  1780  1810  1820
A9$      0520  1560  1580  1780  1800  1810
C9[      0520  1110  1230  1250  1290  1330  1340  1360  1370  1420
         1450
C[       0520  0750  0760  0770  0780  0890  0900  0950  1150  1170
         1190  1210  1390
```

```
C-O-N-T-I-N-U-O-U-S   F-L-O-W   A-N-A-L-Y-Z-E-R   A-U-T-O   S-Y-S-T-E-M
5/23/1980                                                            PAGE  7
                          SYMBOL TABLE FOR CFA16

SYMBOL   REFERENCES
------   -------------------------------------------------------------
 D2      0890  0920  0970  1360
 FL#0    0570  0580  0630  0640  0650  0660  0670  0820  0830  0840
         0920  0970  1100  1160  1280  1320  1370  1400  1430  1450
         1490  1520  1560  1600  1660  1780  1880
 FL#4    0530  0750  0980  1020  1170  1190  1210
 FL#5    0150  0550  0560
 FL#7    1680  1820  1840  1870
 G       0700  0800  0810
 I       0990  1000  1010  1030  1040  1050  1060  1080  1090  1110
         1130  1180  1230  1250  1270  1290  1310  1330  1340  1360
         1370  1380  1530  1550  1610  1630
 I9      1070  1080  1220  1270  1310
 N       0530  0540  0750  0980  1020  1170  1190  1210
 P       0710  0720  0730  0740  0750  0860  0870  0880  0980  1020
 Q5      1170  1250
 Q6      1170  1250
 Q7      1170
 R6      0150  0160
 R7      0150  0650  0980  1070  1190
 R8      0150  0650  1020  1080  1210
 R9$     0520  0530
 S       0980  1020  1190  1210
 S$      0520  0750  0920
 S2[     0520  1000  1040  1090  1130  1270  1310  1360
 S[      0520  1000  1040  1220  1250
 W       0530  0730
 W2      0530  0870  0880
 W5      0550
 W5[     0540  1220  1310
 W6      0560
 W6[     0540  1220  1270
 X8      1760  1800  1830  1850
```

SECTION 19

PROGRAM CFA17 - RUN RESULTS FILE FILLER

CFA17 is the program which places all of the calculated results into the run results file for transmission to the Sample File Control computer. It is entered by chaining from either CFA00 or CFA16. It chains to program CFA00 if the ESCAPE key is pressed.

The program first checks whether CFA003 and CFA004 exist and whether they match. It checks whether CFA004 has gone through all of the post run processing. It checks whether the run file which was assimilated at the beginning of the run still exists. If all of these prerequisites are met, the program asks the user whether the calculated results are approved for transmission to Sample File Control. The default answer to this question is "no" if it is not answered within two minutes. If any of the prerequisites are not met, or if the user does not approve the results, the program chains directly to CFA00.

To begin the process of creating a run results file, the program reads the header record from the run file, changes its date and time, and writes the header record into CFA000.

The program then begins the process of placing the calculated results into run results file format. It does this by writing the formatted result into it, and then printing the record into CFA000. All of the run file records which do not require a result (such as quality control limit records and dummy records) are also copied in order into CFA000.

For a set standard or a blank, the program puts the peak height into the run results record. For a calibration standard or a check standard, the program puts the baseline corrected peak height into the run results record.

For an unknown, the program puts the calculated concentration into the run results record. If necessary, it acquires the calculated concentration from a repeat position. The program also puts the non-numeric qualifier "BDL" or "GTL" into the run results record, as required.

For a duplicate, the program puts the calculated concentration and, if necessary, a non-numeric qualifier into the run results record.

For a laboratory control standard or a reagent blank, the program places the calculated concentration and, if necessary, a non-numeric qualifier into the run results record. A reagent blank is never labeled "BDL."

For a spiked sample, the program places the calculated concentration and the calculated LSA value into the run results record, and if necessary, marks the concentration with a non-numeric qualifier.

When the entire batch has been processed, the program deletes the run file and renames file CFA000 to the appropriate run results file name. Finally, the program allows the user to print the run results file on the lineprinter, the terminal, both, or neither. When that task is completed, the program chains back to CFA00.

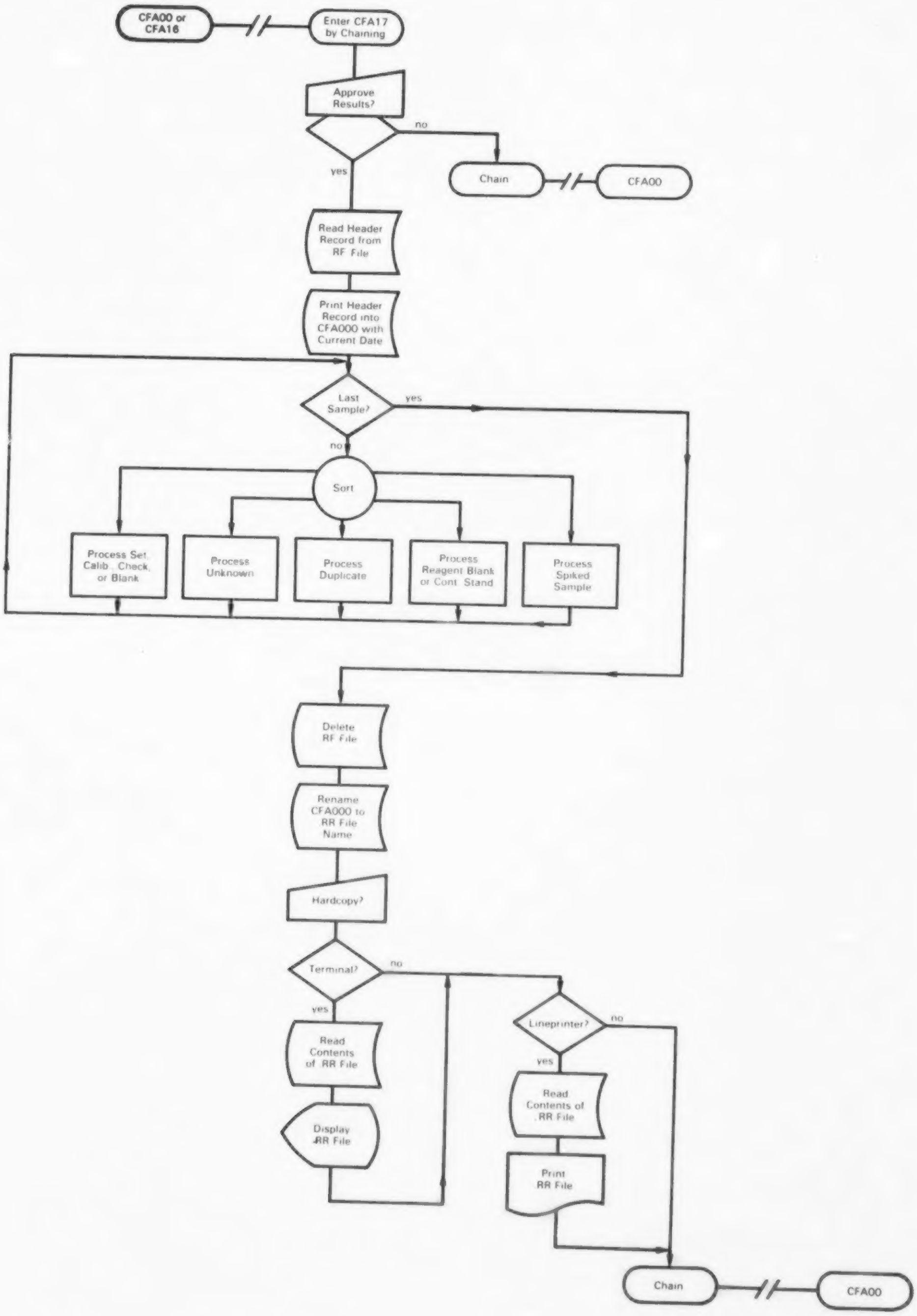
CFA00 or CFA16
Enter CFA17 by Chaining
Approve Results?
no
Chain
CFA00
yes
Read Header Record from RF File
Print Header Record into CFA000 with Current Date
Last Sample?
yes
no
Sort
Process Set, Calib., Check, or Blank
Process Unknown
Process Duplicate
Process Reagent Blank or Cont. Stand
Process Spiked Sample
Delete RF File
Rename CFA000 to RR File Name
Hardcopy?
Terminal?
no
yes
Read Contents of RR File
Display RR File
Lineprinter?
no
yes
Read Contents of RR File
Print RR File
Chain
CFA00

Figure 23. Functional Flowchart for Program CFA17

TABLE 23. SYMBOL DEFINITIONS FOR CFA17

A$	the user's response to several questions
A2$	the superstring of parameter-method codes
A3$	a general-purpose string of formatted data
C()	the array of data common to all analytes for a wheel position; see symbol definitions for CFA03
D2	the dilution factor
E	the exponent for a number in scientific notation
I	the control variable for loops
N	the number of analytes
N$	a number in scientific notation
N1$	part of a number being transformed into scientific notation
P	the wheel position currently being dealt with
Q	the current run file record number
Q5	the volume of the sample
Q6	the volume of the dilution water
Q7	a dummy variable
R9$	the name of the run file
S$	the sample ID
S3()	the data specific to one analyte for a second wheel position
S()	the data specific to one analyte for a wheel position; see symbol definitions for CFA03
T	the time between peaks
U$	the superstring of default concentration units
U2$	one default concentration unit
W	the number of wheel positions occupied by the entire batch
W2	the number of positions in one wheel
W5()	the array of detection limits
W6()	the array of offscale concentrations
X	a number being sent to the subroutine to be transformed into scientific notation
X8	the counter for the number of lines printed on one page on the lineprinter
Z	a flag for which a value of 0 implies that the final report has never been prepared, and a value of 1 implies that it has

```
C-O-N-T-I-N-U-O-U-S  F-L-O-W  A-N-A-L-Y-Z-E-R  A-U-T-O  S-Y-S-T-E-M
5/23/1980                                                   PAGE  1
                     PROGRAM LISTING FOR CFA17

123456789112345678921234567893123456789412345678951234567896123456789 7
         0         0         0         0         0         0         0
0010 REM   +=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+
0020 REM   +   CONTINUOUS FLOW ANALYZER AUTOMATION SYSTEM          +
0030 REM   +   PROGRAM CFA17, RUN RESULTS FILE FILLER              +
0040 REM   +   BY:  J. KOPKE (UCCC)     MARCH 24, 1980             +
0050 REM   +   MOST RECENT REVISION:  APRIL 14, 1980               +
0060 REM   +=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+
0070 REM
0080 DIM A2$[21],R9$[13],A$[1],A3$[79],N$[10],C[4],S[14],S3[14],U$[3],
*    U2$[8]
0090 ON ESC THEN GOTO 0120
0100 ESC
0110 GOTO 0150
0120 NOESC
0130 CLOSE
0140 CHAIN "CFA00"
0150 ON ERR THEN GOTO 0170
0160 RENAME "CFA003","CFA003"
0170 ON ERR THEN STOP
0180 IF SYS(7)<>-9 THEN GOTO 0300
0190 ON ERR THEN GOTO 0210
0200 RENAME "CFA004","CFA004"
0210 ON ERR THEN STOP
0220 IF SYS(7)<>-9 THEN GOTO 0300
0230 OPEN FILE[4,0],"CFA003",56
0240 READ FILE[4,0],N,A2$,R9$,W,W2,Z
0250 IF Z<>1 THEN GOTO 0300
0260 IF R9$="0000000.RF" THEN GOTO 0120
0270 OPEN FILE[5,0],"CFA004",22
0280 READ FILE[5,0],A3$
0290 IF A3$[1,N*7]=A2$[1,N*7] THEN GOTO 0330
0300 PRINT
0310 PRINT "<7>THE SYSTEM DOES NOT HAVE SUFFICIENT DATA TO PROCEED FRO
*    M THIS POINT"
0320 GOTO 0120
0330 ON ERR THEN GOTO 0350
0340 RENAME R9$,R9$
0350 ON ERR THEN STOP
0360 IF SYS(7)=-9 THEN GOTO 0430
0370 PRINT
0380 PRINT "<7>THE RUN FILE NAMED ";R9$;" WHICH WAS USED TO CREATE THI
*    S BATCH IS GONE,"
0390 PRINT "     AND THE RESULTS OF THIS BATCH CANNOT BE RETURNED TO S
*    FC"

123456789112345678921234567893123456789412345678951234567896123456789 7
         0         0         0         0         0         0         0
```

```
C-O-N-T-I-N-U-O-U-S  F-L-O-W  A-N-A-L-Y-Z-E-R  A-U-T-O  S-Y-S-T-E-M
5/23/1980                                                   PAGE  2
                     PROGRAM LISTING FOR CFA17

123456789112345678921234567893123456789412345678951234567896123456789 7
         0         0         0         0         0         0         0
0400 GOTO 0120
0410 REM   ----------------------------------------------------------
0420 REM           APPROVAL QUESTION
0430 PRINT
0440 PRINT "APPROVE RESULTS TO FILL SFC RUN RESULTS FILE ([N],Y) >>  "
*    ;
0450 TIME =120
0460 ON ERR THEN GOTO 0500
0470 TINPUT "",A$
0480 ON ERR THEN STOP
0490 GOTO 0550
0500 ON ERR THEN STOP
0510 IF SYS(7)<>60 THEN GOTO 0550
0520 PRINT
0530 PRINT "NO RESPONSE IN 2 MINUTES HAS IMPLIED AN ANSWER OF 'N'"
0540 LET A$="N"
0550 IF A$="" THEN GOTO 0120
0560 IF A$="N" THEN GOTO 0120
0570 IF A$="Y" THEN GOTO 0630
0580 PRINT
0590 PRINT "<7>INVALID RESPONSE"
0600 GOTO 0430
0610 REM   ----------------------------------------------------------
0620 REM           RUN RESULTS FILE HOUSEKEEPING
0630 PRINT
0640 PRINT "THE RUN RESULTS FILE IS BEING FILLED...";
0650 OPEN FILE[0,1],"CFA000"
0660 OPEN FILE[3,3],R9$
0670 LREAD FILE[3],A3$
0680 LET A3$[3,4]=STR$(SYS(3)-1900)
0690 LET A3$[6,16]="00 00 00 00"
0700 LET A3$[8-LEN(STR$(SYS(2))),7]=STR$(SYS(2))
0710 LET A3$[11-LEN(STR$(SYS(1))),10]=STR$(SYS(1))
0720 LET A3$[14-LEN(STR$(SYS(11))),13]=STR$(SYS(11))
0730 LET A3$[17-LEN(STR$(SYS(12))),16]=STR$(SYS(12))
0740 PRINT FILE[0],A3$
0750 LET Q=1
0760 DIM W5[N],W6[N]
0770 READ FILE[5,1],T,U$
0780 MAT READ FILE[5,9],W5
0790 MAT READ FILE[5,10],W6
0800 LET U2$=" G/L    "

123456789112345678921234567893123456789412345678951234567896123456789 7
         0         0         0         0         0         0         0
```

```
C-O-N-T-I-N-U-O-U-S  F-L-O-W  A-N-A-L-Y-Z-E-R  A-U-T-O  S-Y-S-T-E-M
5/23/1980                                                    PAGE  3
                    PROGRAM LISTING FOR CFA17

 12345678911234567892123456789312345678941234567895123456789612345678970
          0         0         0         0         0         0         0
 0810 REM    ----------------------------------------------------------
 0820 REM          SORT
 0830 LET P=0
 0840 LET P=P+1
 0850 IF P>W THEN GOTO 2290
 0860 IF P/10=INT(P/10) THEN PRINT ".";
 0870 READ FILE[4,(P-1)*(N+1)+1],C[1],C[2],C[3],C[4],S$
 0880 ON C[1] THEN GOTO 0910, 0910, 1130, 1850, 1420, 1620, 1620, 0910,
*      0910, 0840, 0840
 0890 REM    ----------------------------------------------------------
 0900 REM          SET, CALIBRATION, OR CHECK STANDARD OR BLANK
 0910 FOR I=1 TO N
 0920   MAT READ FILE[4,(P-1)*(N+1)+1+I],S
 0930   GOSUB 3060
 0940   IF A3$[1,1]<>"3" THEN GOTO 2210
 0950   IF C[1]=1 THEN IF A3$[39,39]="T" THEN GOTO 1000
 0960   IF C[1]=2 THEN IF A3$[39,39]="S" THEN GOTO 1030
 0970   IF C[1]=8 THEN IF A3$[39,40]="CS" THEN GOTO 1030
 0980   IF C[1]=9 THEN IF A3$[39,39]="B" THEN GOTO 1000
 0990   GOTO 2210
 1000   IF S[1]<-1000 THEN GOTO 1070
 1010   LET X=S[1]
 1020   GOTO 1050
 1030   IF S[2]<-1000 THEN GOTO 1070
 1040   LET X=S[2]
 1050   GOSUB 3150
 1060   LET A3$[28,37]=N$
 1070   PRINT FILE[0],A3$
 1080   LET Q=Q+1
 1090 NEXT I
 1100 GOTO 0840
 1110 REM    ----------------------------------------------------------
 1120 REM          UNKNOWN
 1130 LET D2=(C[2]+C[3])/C[2]
 1140 FOR I=1 TO N
 1150   MAT READ FILE[4,(P-1)*(N+1)+1+I],S
 1160   GOSUB 3060
 1170   IF A3$[1,1]<>"2" THEN GOTO 2210
 1180   IF A3$[3,10]<>S$ THEN GOTO 2210
 1190   IF C[1]=3 THEN IF A3$[12,14]="   " THEN GOTO 1240
 1200   IF C[1]=3.1 THEN IF A3$[12,14]="LSO" THEN GOTO 1240
 1210   IF C[1]=3.2 THEN IF A3$[12,14]="LD1" THEN GOTO 1240

 12345678911234567892123456789312345678941234567895123456789612345678970
          0         0         0         0         0         0         0
```

```
C-O-N-T-I-N-U-O-U-S  F-L-O-W  A-N-A-L-Y-Z-E-R  A-U-T-O  S-Y-S-T-E-M
5/23/1980                                                    PAGE  4
                    PROGRAM LISTING FOR CFA17

12345678911234567892123456789312345678941234567895123456789612345678970
         0         0         0         0         0         0         0
1220   IF C[1]=3.3 THEN IF A3$[12,14]="LDX" THEN GOTO 1240
1230   GOTO 2210
1240   IF S[12]=-99999 THEN GOTO 1360
1250   IF S[12]<>-88888 THEN GOTO 1310
1260   READ FILE[4,(C[4]-1)*(N+1)+1],Q7,Q5,Q6
1270   MAT READ FILE[4,(C[4]-1)*(N+1)+1+I],S
1280   IF S[12]<-1000 THEN GOTO 1360
1290   LET X=S[12]*(Q5+Q6)/Q5
1300   GOTO 1320
1310   LET X=S[12]*D2
1320   GOSUB 3150
1330   LET A3$[28,37]=N$
1340   IF S[12]<W5[I] THEN LET A3$[48,50]="BDL"
1350   IF S[12]>=W6[I] THEN LET A3$[48,50]="GTL"
1360   GOSUB 3380
1370   LET Q=Q+1
1380 NEXT I
1390 GOTO 0840
1400 REM    ----------------------------------------------------------
1410 REM          DUPLICATE
1420 READ FILE[4,(C[4]-1)*(N+1)+1],Q7,Q5,Q6
1430 LET D2=(Q5+Q6)/Q5
1440 FOR I=1 TO N
1450   MAT READ FILE[4,(P-1)*(N+1)+1+I],S
1460   GOSUB 3060
1470   IF A3$[1,1]<>"2" THEN GOTO 2210
1480   IF A3$[3,10]<>S$ THEN GOTO 2210
1490   IF A3$[12,13]<>"LD" THEN GOTO 2210
1500   IF S[12]<-1000 THEN GOTO 1560
1510   LET X=S[12]*D2
1520   GOSUB 3150
1530   LET A3$[28,37]=N$
1540   IF S[12]<W5[I] THEN LET A3$[48,50]="BDL"
1550   IF S[12]>=W6[I] THEN LET A3$[48,50]="GTL"
1560   GOSUB 3380
1570   LET Q=Q+1
1580 NEXT I
1590 GOTO 0840
1600 REM    ----------------------------------------------------------
1610 REM          LABORATORY CONTROL STANDARD OR REAGENT BLANK
1620 FOR I=1 TO N
1630   MAT READ FILE[4,(P-1)*(N+1)+1+I],S

12345678911234567892123456789312345678941234567895123456789612345678970
         0         0         0         0         0         0         0
```

```
C-O-N-T-I-N-U-O-U-S   F-L-O-W   A-N-A-L-Y-Z-E-R   A-U-T-O   S-Y-S-T-E-M
5/23/1980                                                        PAGE  5
                        PROGRAM LISTING FOR CFA17

123456789112345678921234567893123456789412345678951234567896123456789 7
         0         0         0         0         0         0         0
1640    GOSUB 3060
1650    IF A3$[1,1]<>"2" THEN GOTO 2210
1660    IF C[1]=6 THEN IF A3$[12,14]="LCM" THEN GOTO 1690
1670    IF C[1]=7 THEN IF A3$[12,14]="LRB" THEN GOTO 1690
1680    GOTO 2210
1690    IF S[12]<-1000 THEN GOTO 1750
1700    LET X=S[12]
1710    GOSUB 3150
1720    LET A3$[28,37]=N$
1730    IF C[1]=6 THEN IF S[12]<W5[I] THEN LET A3$[48,50]="BDL"
1740    IF S[12]>=W6[I] THEN LET A3$[48,50]="GTL"
1750    GOSUB 3380
1760    LET Q=Q+1
1770    IF C[1]<>6 THEN GOTO 1810
1780    LREAD FILE[3],A3$
1790    GOSUB 3380
1800    LET Q=Q+1
1810 NEXT I
1820 GOTO 0840
1830 REM  ------------------------------------------------------------------
1840 REM          SPIKED SAMPLE
1850 LET Q5=C[2]
1860 LET Q6=C[4]
1870 READ FILE[4,(Q6-1)*(N+1)+1],C[1],C[2],C[3],C[4],S$
1880 LET D2=(C[2]+C[3]+Q5)/(C[2]+Q5)
1890 FOR I=1 TO N
1900    MAT READ FILE[4,(P-1)*(N+1)+1+I],S
1910    GOSUB 3060
1920    IF A3$[1,1]<>"2" THEN GOTO 2210
1930    IF A3$[3,10]<>S$ THEN GOTO 2210
1940    IF A3$[12,14]<>"LSF" THEN GOTO 2210
1950    IF S[12]<-1000 THEN GOTO 2010
1960    LET X=S[12]*D2
1970    GOSUB 3150
1980    LET A3$[28,37]=N$
1990    IF S[12]<W5[I] THEN LET A3$[48,50]="BDL"
2000    IF S[12]>=W6[I] THEN LET A3$[48,50]="GTL"
2010    GOSUB 3380
2020    LET Q=Q+1
2030    LREAD FILE[3],A3$
2040    IF A3$[1,1]<>"2" THEN GOTO 2210
2050    IF A3$[3,10]<>S$ THEN GOTO 2210

123456789112345678921234567893123456789412345678951234567896123456789 7
         0         0         0         0         0         0         0
```

```
C-O-N-T-I-N-U-O-U-S   F-L-O-W   A-N-A-L-Y-Z-E-R   A-U-T-O   S-Y-S-T-E-M
5/23/1980                                                        PAGE  6
                        PROGRAM LISTING FOR CFA17

123456789112345678921234567893123456789412345678951234567896123456789 7
         0         0         0         0         0         0         0
2060    IF A3$[12,14]<>"LSA" THEN GOTO 2210
2070    IF Q5<>0 THEN GOTO 2100
2080    LET X=S[13]/C[2]
2090    GOTO 2130
2100    MAT READ FILE[4,(Q6-1)*(N+1)+1+I],S3
2110    IF S3[12]<-1000 THEN GOTO 2150
2120    LET X=(S[13]*Q5*C[2]-S3[12]*C[2]*Q5-S3[12]*Q5*C[3])/(C[2]*C[2]+
*   C[2]*Q5)
2130    GOSUB 3150
2140    LET A3$[28,37]=N$
2150    GOSUB 3380
2160    LET Q=Q+1
2170 NEXT I
2180 GOTO 0840
2190 REM  ------------------------------------------------------------------
2200 REM          MISMATCHED RUN FILE
2210 PRINT
2220 PRINT "<7>THE RUN FILE HAS BEEN CHANGED SINCE IT WAS ASSIMILATED
*    BY THIS SYSTEM;"
2230 PRINT "     THERE IS NO WAY TO REPORT THESE RESULTS TO SFC"
2240 NOESC
2250 CLOSE
2260 CHAIN "CFA00"
2270 REM  ------------------------------------------------------------------
2280 REM          HARD COPY
2290 NOESC
2300 CLOSE
2310 DELETE R9$
2320 LET R9$[LEN(R9$)]="R"
2330 RENAME "CFA000",R9$
2340 ESC
2350 PRINT
2360 GOTO 2430
2370 PRINT
2380 PRINT "H = HELP"
2390 PRINT "L = LINEPRINTER"
2400 PRINT "T = TERMINAL"
2410 PRINT "B = BOTH LINEPRINTER AND TERMINAL"
2420 PRINT "N = NEITHER LINEPRINTER NOR TERMINAL"
2430 PRINT
2440 PRINT "FORM OF RUN RESULTS FILE REPORT ([H],L,T,B,N) >>  ";
2450 TIME =120

123456789112345678921234567893123456789412345678951234567896123456789 7
         0         0         0         0         0         0         0
```

```
C-O-N-T-I-N-U-O-U-S   F-L-O-W   A-N-A-L-Y-Z-E-R   A-U-T-O   S-Y-S-T-E-M
5/23/1980                                                            PAGE  7
                        PROGRAM LISTING FOR CFA17

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
2460 ON ERR THEN GOTO 2500
2470 TINPUT "",A$
2480 ON ERR THEN STOP
2490 GOTO 2550
2500 ON ERR THEN STOP
2510 IF SYS(7)<>60 THEN GOTO 2550
2520 PRINT
2530 PRINT "NO RESPONSE IN TWO MINUTES HAS IMPLIED AN ANSWER OF 'N'"
2540 LET A$="N"
2550 IF A$="" THEN GOTO 2370
2560 IF A$="H" THEN GOTO 2370
2570 IF A$="L" THEN GOTO 2640
2580 IF A$="T" THEN GOTO 2640
2590 IF A$="B" THEN GOTO 2640
2600 IF A$="N" THEN GOTO 2640
2610 PRINT
2620 PRINT "<7>INVALID RESPONSE"
2630 GOTO 2370
2640 IF A$<>"T" THEN IF A$<>"B" THEN GOTO 2770
2650 OPEN FILE[3,3],R9$
2660 FOR I=1 TO 5
2670   PRINT
2680 NEXT I
2690 LREAD FILE[3],A3$
2700 IF EOF(3) THEN GOTO 2730
2710 PRINT A3$[1,65]
2720 GOTO 2690
2730 CLOSE
2740 FOR I=1 TO 5
2750   PRINT
2760 NEXT I
2770 IF A$<>"L" THEN IF A$<>"B" THEN GOTO 3000
2780 PRINT
2790 PRINT "THE REPORT IS BEING SENT TO THE LINEPRINTER...";
2800 OPEN FILE[3,3],R9$
2810 ON ERR THEN GOTO 2850
2820 OPEN FILE[7,1],"$LPT"
2830 ON ERR THEN STOP
2840 GOTO 2900
2850 ON ERR THEN STOP
2860 PRINT
2870 PRINT "THE LINEPRINTER IS IN USE; THERE WILL BE A 10-SECOND DELAY
*     "

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
```

```
C-O-N-T-I-N-U-O-U-S   F-L-O-W   A-N-A-L-Y-Z-E-R   A-U-T-O   S-Y-S-T-E-M
5/23/1980                                                            PAGE  8
                        PROGRAM LISTING FOR CFA17

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
2880 DELAY =10
2890 GOTO 2810
2900 LET X8=0
2910 LREAD FILE[3],A3$
2920 IF EOF(3) THEN GOTO 3000
2930 PRINT FILE[7],A3$
2940 LET X8=X8+1
2950 IF X8<>63 THEN GOTO 2910
2960 PRINT FILE[7],"<12>"
2970 LET X8=0
2980 PRINT ".";
2990 GOTO 2910
3000 CLOSE
3010 PRINT
3020 NOESC
3030 CHAIN "CFA00"
3040 REM   +++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
3050 REM          SUBROUTINE TO ADVANCE RUN FILE
3060 IF Q=S[14]-1 THEN GOTO 3110
3070 LREAD FILE[3],A3$
3080 PRINT FILE[0],A3$
3090 LET Q=Q+1
3100 GOTO 3060
3110 LREAD FILE[3],A3$
3120 RETURN
3130 REM   +++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
3140 REM          SUBROUTINE TO CONVERT NUMBER TO EXPONENTIAL NOTATION
3150 LET N$="+0.000E+00"
3160 IF X=0 THEN GOTO 3350
3170 IF X<0 THEN LET N$[1,1]="-"
3180 LET X=ABS(X)
3190 LET E=0
3200 IF X<.9995 THEN GOTO 3250
3210 IF X<9.9995 THEN GOTO 3280
3220 LET X=X/10
3230 LET E=E+1
3240 GOTO 3200
3250 LET X=X*10
3260 LET E=E-1
3270 GOTO 3200
3280 LET X=X+5E-04
3290 LET N1$=STR$(X)

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
```

TYPING GUIDE SHEET

BEGIN FIRST LINE OF TEXT HERE

DROPPED HEAD BEGIN SECTIONS HERE

BEGIN LAST LINE OF TEXT

```
C-O-N-T-I-N-U-O-U-S   F-L-O-W   A-N-A-L-Y-Z-E-R   A-U-T-O   S-Y-S-T-E-M
5/23/1980                                                         PAGE  9
                      PROGRAM LISTING FOR CFA17

 1234567891123456789212345678931234567894123456789512345678961234567897
          0         0         0         0         0         0         0
 3300 IF LEN(N1$)>5 THEN LET N1$=N1$[1,5]
 3310 LET N$[2,LEN(N1$)+1]=N1$
 3320 IF E<0 THEN LET N$[8,8]="-"
 3330 LET N1$=STR$(ABS(E))
 3340 LET N$[11-LEN(N1$),10]=N1$
 3350 RETURN
 3360 REM    +++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
 3370 REM         SUBROUTINE TO WRITE OVER THE UNITS FIELD
 3380 LET U2$[1,1]=U$[I,I]
 3390 LET A3$[39,46]=U2$
 3400 PRINT FILE[0],A3$
 3410 RETURN




























 1234567891123456789212345678931234567894123456789512345678961234567897
          0         0         0         0         0         0         0
```

```
C-O-N-T-I-N-U-O-U-S   F-L-O-W   A-N-A-L-Y-Z-E-R   A-U-T-O   S-Y-S-T-E-M
5/23/1980                                                        PAGE 10
                        SYMBOL TABLE FOR CFA17

SYMBOL    REFERENCES
------  ------------------------------------------------------------------
 0120   0090  0260  0320  0400  0550  0560
 0150   0110
 0170   0150
 0210   0190
 0300   0180  0220  0250
 0330   0290
 0350   0330
 0430   0360  0600
 0500   0460
 0550   0490  0510
 0630   0570
 0840   0880  1100  1390  1590  1820  2180
 0910   0880
 1000   0950  0980
 1030   0960  0970
 1050   1020
 1070   1000  1030
 1130   0880
 1240   1190  1200  1210  1220
 1310   1250
 1320   1300
 1360   1240  1280
 1420   0880
 1560   1500
 1620   0880
 1690   1660  1670
 1750   1690
 1810   1770
 1850   0880
 2010   1950
 2100   2070
 2130   2090
 2150   2110
 2210   0940  0990  1170  1180  1230  1470  1480  1490  1650  1680
        1920  1930  1940  2040  2050  2060
 2290   0850
 2370   2550  2560  2630
 2430   2360
 2500   2460
 2550   2490  2510
 2640   2570  2580  2590  2600
 2690   2720
 2730   2700
 2770   2640
 2810   2890
```

```
C-O-N-T-I-N-U-O-U-S   F-L-O-W   A-N-A-L-Y-Z-E-R   A-U-T-O   S-Y-S-T-E-M
5/23/1980                                                        PAGE 11
                    SYMBOL TABLE FOR CFA17

SYMBOL    REFERENCES
------  ------------------------------------------------------  --------
 2850   2810
 2900   2840
 2910   2950  2990
 3000   2770  2920
 3060   0930  1160  1460  1640  1910  3100
 3110   3060
 3150   1050  1320  1520  1710  1970  2130
 3200   3240  3270
 3250   3200
 3280   3210
 3350   3160
 3380   1360  1560  1750  1790  2010  2150
 A$     0080  0470  0540  0550  0560  0570  2470  2540  2550  2560
        2570  2580  2590  2600  2640  2770
 A2$    0080  0240  0290
 A3$    0080  0280  0290  0670  0680  0690  0700  0710  0720  0730
        0740  0940  0950  0960  0970  0980  1060  1070  1170  1180
        1190  1200  1210  1220  1330  1340  1350  1470  1480  1490
        1530  1540  1550  1650  1660  1670  1720  1730  1740  1780
        1920  1930  1940  1980  1990  2000  2030  2040  2050  2060
        2140  2690  2710  2910  2930  3070  3080  3110  3390  3400
 C[     0080  0870  0880  0950  0960  0970  0980  1130  1190  1200
        1210  1220  1260  1270  1420  1660  1670  1730  1770  1850
        1860  1870  1880  2080  2120
 D2     1130  1310  1430  1510  1880  1960
 E      3190  3230  3260  3320  3330
 FL#0   0650  0740  1070  3080  3400
 FL#3   0660  0670  1780  2030  2650  2690  2800  2910  3070  3110
 FL#4   0230  0240  0870  0920  1150  1260  1270  1420  1450  1630
        1870  1900  2100
 FL#5   0270  0280  0770  0780  0790
 FL#7   2820  2930  2960
 I      0910  0920  1090  1140  1150  1270  1340  1350  1380  1440
        1450  1540  1550  1580  1620  1630  1730  1740  1810  1890
        1900  1990  2000  2100  2170  2660  2680  2740  2760  3380
 N      0240  0290  0760  0870  0910  0920  1140  1150  1260  1270
        1420  1440  1450  1620  1630  1870  1890  1900  2100
 N$     0080  1060  1330  1530  1720  1980  2140  3150  3170  3310
        3320  3340
 N1$    3290  3300  3310  3330  3340
 P      0830  0840  0850  0860  0870  0920  1150  1450  1630  1900
 Q      0750  1080  1370  1570  1760  1800  2020  2160  3060  3090
 Q5     1260  1290  1420  1430  1850  1880  2070  2120
 Q6     1260  1290  1420  1430  1860  1870  2100
 Q7     1260  1420
```

```
C-O-N-T-I-N-U-O-U-S   F-L-O-W   A-N-A-L-Y-Z-E-R   A-U-T-O   S-Y-S-T-E-M
5/23/1980                                                        PAGE 12
                    SYMBOL TABLE FOR CFA17

SYMBOL    REFERENCES
------  ---------------------------------------------------------------
 R9$    0080  0240  0260  0340  0380  0660  2310  2320  2330  2650
        2800
 S      0920  1150  1270  1450  1630  1900
 S$     0870  1180  1480  1870  1930  2050
 S3     2100
 S3[    0080  2110  2120
 S[     0080  1000  1010  1030  1040  1240  1250  1280  1290  1310
        1340  1350  1500  1510  1540  1550  1690  1700  1730  1740
        1950  1960  1990  2000  2080  2120  3060
 T      0770
 U$     0080  0770  3380
 U2$    0080  0800  3380  3390
 W      0240  0850
 W2     0240
 W5     0780
 W5[    0760  1340  1540  1730  1990
 W6     0790
 W6[    0760  1350  1550  1740  2000
 X      1010  1040  1290  1310  1510  1700  1960  2080  2120  3160
        3170  3180  3200  3210  3220  3250  3280  3290
 X8     2900  2940  2950  2970
 Z      0240  0250
```

SECTION 20

PROGRAM CFA18 - INTERFACE CHECKER

Program CFA18 is the program for checking the interface hardware. It is entered by chaining from the master command program, CFA00, and it chains back to that program if the ESCAPE key is pressed.

The program simply asks for the number of the analogue to digital converter channel to be tested. It then uses the CALL 5 to take readings from that channel as fast as BASIC will allow, and displays these readings.

After 720 readings have been displayed, the program chains back to CFA00.

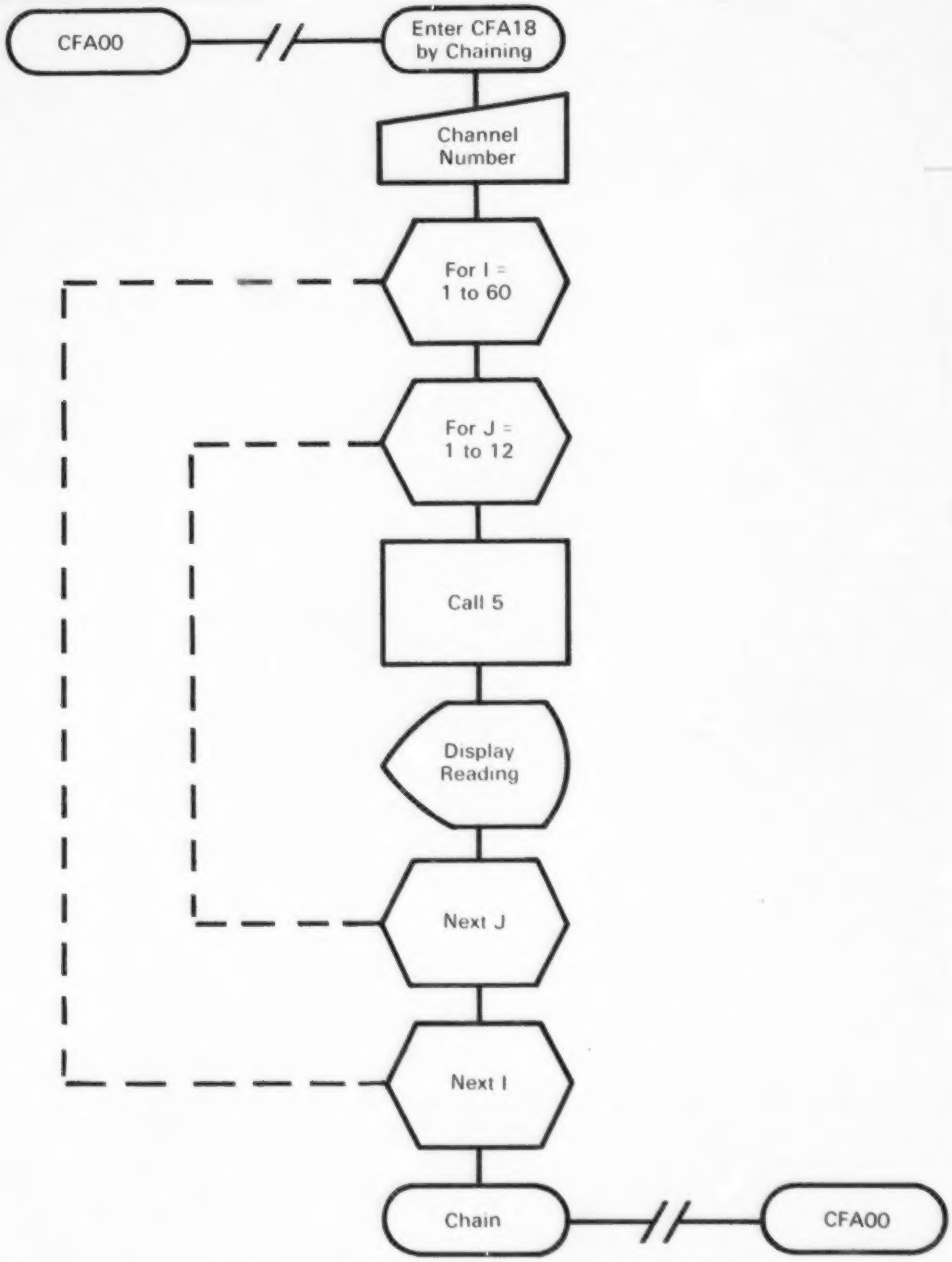
CFA00
Enter CFA18 by Chaining
Channel Number
For I = 1 to 60
For J = 1 to 12
Call 5
Display Reading
Next J
Next I
Chain
CFA00

Figure 24. Functional Flowchart for Program CFA18.

TABLE 19. SYMBOL DEFINITIONS FOR PROGRAM CFA18

A9	the number of the analogue to digital converter channel being tested.
B9	the value read from the analogue to digital converter
I	the control variable for loops
J	the control variable for loops

```
C-O-N-T-I-N-U-O-U-S   F-L-O-W   A-N-A-L-Y-Z-E-R   A-U-T-O   S-Y-S-T-E-M
5/23/1980                                                          PAGE  1
                    PROGRAM LISTING FOR CFA18

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
0010 REM   +=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+
0020 REM   +   CONTINUOUS FLOW ANALYZER AUTOMATION SYSTEM                +
0030 REM   +   PROGRAM CFA18, INTERFACE CHECKER                          +
0040 REM   +   BY:  J. KOPKE (UCCC)     DECEMBER 17, 1979                +
0050 REM   +   MOST RECENT REVISION:  APRIL 15, 1980                     +
0060 REM   +=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+
0070 REM
0080 ON ESC THEN GOTO 0230
0090 ESC
0100 PRINT
0110 ON ERR THEN GOTO 0130
0120 INPUT "A/D CHANNEL TO BE TESTED >>  ",A9
0130 ON ERR THEN STOP
0140 LET B9=0
0150 PRINT
0160 FOR I=1 TO 60
0170   FOR J=1 TO 12
0180     CALL 5,A9,B9
0190     PRINT USING "##### ",B9;
0200   NEXT J
0210   PRINT
0220 NEXT I
0230 NOESC
0240 PRINT
0250 CHAIN "CFA00"

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
```

```
C-O-N-T-I-N-U-O-U-S   F-L-O-W   A-N-A-L-Y-Z-E-R   A-U-T-O   S-Y-S-T-E-M
5/23/1980                                                          PAGE  2
                              SYMBOL TABLE FOR CFA18

SYMBOL    REFERENCES
------    ----------------------------------------------------------------
 0130     0110
 0230     0080
 A9       0120  0180
 B9       0140  0180  0190
 I        0160  0220
 J        0170  0200
```

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SECTION 21

PROGRAM CFA19 - RAW DATA REPORTER/PLOTTER

CFA19 is the program which prints the raw data report and/or plots the raw data peaks. It is entered by chaining from CFA00, and it returns to that program if the ESCAPE key is pressed.

The first thing that this program does is to check the raw data file, CFA005, and to tell the user how many wheel positions are available for plotting, if any. The program then asks whether the user wants to have plots or reports of the raw data.

If the user chooses to plot raw data, the program asks for the type of terminal and the analyte and wheel position of interest. The program then clears the screen, prints the headings, and draws and labels the axes. It then reads the raw data from file CFA005 and plots the peaks. The program then sounds the bell four times and allows time for the user to make a hard copy. Finally, the program asks whether the user wants another plot, and then either branches back to begin again or chains back to program CFA00, as directed.

If the user chooses to have a report of the raw data, the program first asks the user where the report should be printed and for the analyte and first and last wheel position of interest. Then the program prints the report headings into file CFA000. Next, the program reads the raw data for each peak from file CFA005 and prints it into file CFA000. The program reproduces the data reduction done by program CFA08, and includes those details in the raw data report also.

When the entire report has been composed in file CFA000, the program copies it to the user's terminal and/or the lineprinter. The program then chains to program CFA00.

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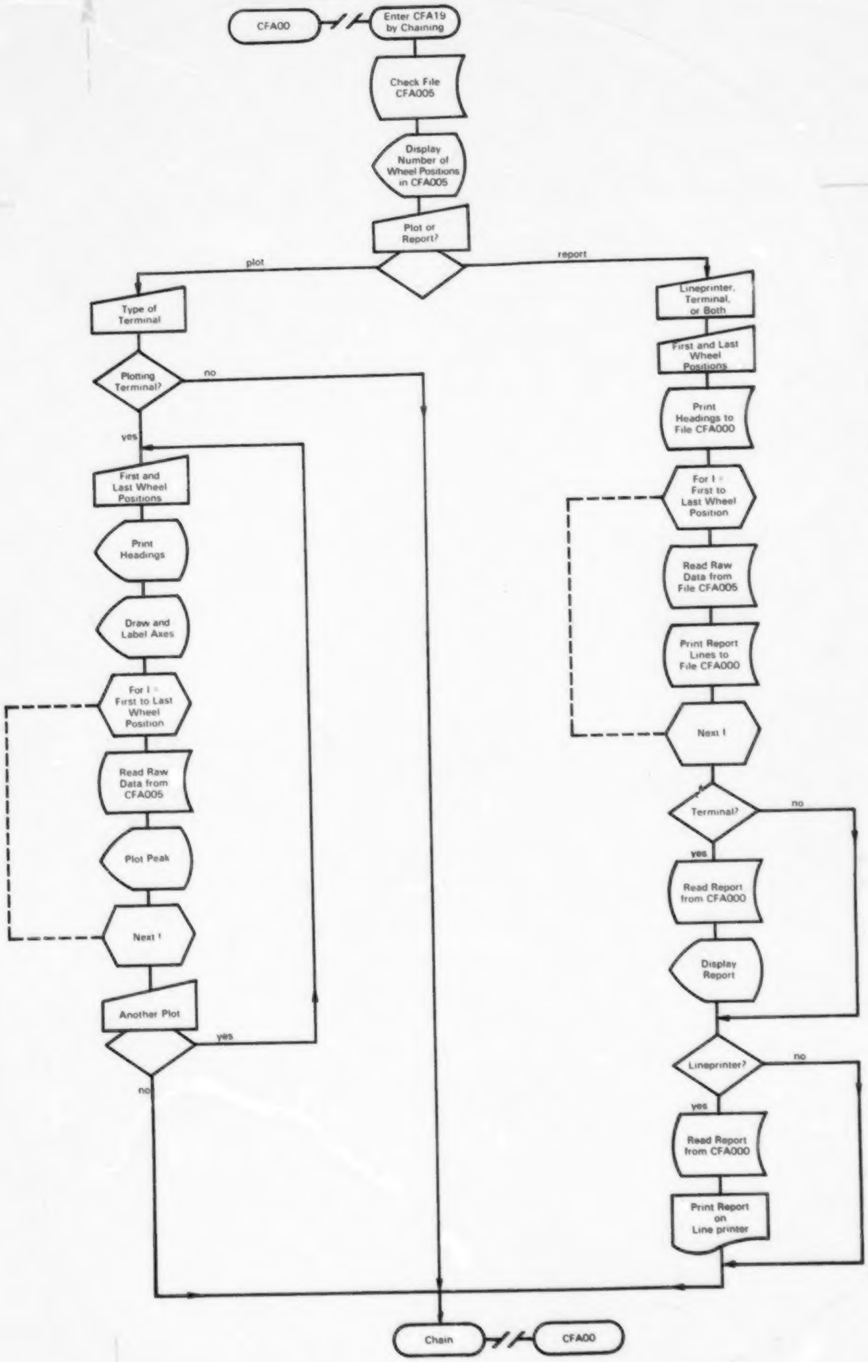
CFA00
Enter CFA19 by Chaining
Check File CFA005
Display Number of Wheel Positions in CFA005
Plot or Report?
plot
report
Type of Terminal
Plotting Terminal?
no
yes
First and Last Wheel Positions
Print Headings
Draw and Label Axes
For I = First to Last Wheel Position
Read Raw Data from CFA005
Plot Peak
Next I
Another Plot
yes
no
Lineprinter, Terminal, or Both
First and Last Wheel Positions
Print Headings to File CFA000
For I = First to Last Wheel Position
Read Raw Data from File CFA005
Print Report Lines to File CFA000
Next I
Terminal?
no
yes
Read Report from CFA000
Display Report
Lineprinter?
no
yes
Read Report from CFA000
Print Report on Line printer
Chain
CFA00

Figure 28. Functional Flowchart for Program CFA19.

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(4-76)

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TABLE 20. SYMBOL DEFINITIONS FOR CFA19

A	the number of the current analyte
A$	the user's response to several questions
A2$	the superstring of parameter-method codes
A3$	a general-purpose string of formatted data
A9$	the semicolon or carriage return for a line of a report read from a file
D2()	the array of sixty analogue to digital converter readings
F9	the first wheel position to be included in a report or plot
G2	the standard deviation of five consecutive readings
H8	the peak height at the expected position
H9	the peak height at the highest level position
I	the control variable for loops
J	the control variable for loops
K	the control variable for loops
L9	the last wheel position to be included in a report or plot
M	the mean height of five consecutive readings for a peak
N	the number of analytes
R0	the sum of the squares of the differences from the mean
T$	the type of terminal
V	the smoothed value for a reading
W7	the number of wheel positions for which there is raw data in the file
X8	the counter for the number of lines printed on one page on the lineprinter
Y	the flag for the algorithm applied
Z	the amount of timing shift in seconds

P1, P1$, P2, P2$, P3, P3$, P4, P4$, P5, P6, P7, P8, P9, P(), Q1, Q2, Q3, Q4, Q5, Q6, Q7, Q8, Q9, Q(), U1, and U2 are symbols used by the plotting subroutines which are documented[5] elsewhere.

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```
C-O-N-T-I-N-U-O-U-S  F-L-O-W  A-N-A-L-Y-Z-E-R  A-U-T-O  S-Y-S-T-E-M
5/23/1980                                                     PAGE  1
                     PROGRAM LISTING FOR CFA19

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
0010 REM   +=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+
0020 REM   +   CONTINUOUS FLOW ANALYZER AUTOMATION SYSTEM              +
0030 REM   +   PROGRAM CFA19, RAW DATA REPORTER/PLOTTER                +
0040 REM   +   BY:  J. KOPKE (UCCC)      APRIL 7, 1980                 +
0050 REM   +   MOST RECENT REVISION:  APRIL 15, 1980                   +
0060 REM   +=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+
0070 REM
0080 PAGE =80
0090 GOSUB 4150
0100 ON ESC THEN GOTO 0160
0110 ESC
0120 GOTO 0190
0130 PRINT "<27>E"
0140 DELAY =.7
0150 PRINT "<27>H<27>J"
0160 NOESC
0170 CLOSE
0180 CHAIN "CFA00"
0190 DIM A$[1],A2$[21],A3$[79],D2[60],T$[1],P[60],Q[60]
0200 ON ERR THEN GOTO 0240
0210 OPEN FILE[6,0],"CFA005",240
0220 ON ERR THEN STOP
0230 GOTO 0280
0240 ON ERR THEN STOP
0250 PRINT
0260 PRINT "<7>THERE IS NO RAW DATA AVAILABLE"
0270 GOTO 0160
0280 READ FILE[6,0],N,A2$,W7
0290 PRINT
0300 PRINT "THERE IS RAW DATA AVAILABLE FOR";W7;"WHEEL POSITIONS"
0310 GOTO 0360
0320 PRINT
0330 PRINT "H = HELP"
0340 PRINT "P = PLOT OF PEAKS"
0350 PRINT "R = REPORT OF RAW DATA"
0360 PRINT
0370 ON ERR THEN GOTO 0390
0380 INPUT "MODE OF RAW DATA DETAILS ([H],P,R) >>  ",A$
0390 ON ERR THEN STOP
0400 IF A$="" THEN GOTO 0320
0410 IF A$="H" THEN GOTO 0320
0420 IF A$="P" THEN GOTO 0540

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
```

```
C-O-N-T-I-N-U-O-U-S  F-L-O-W  A-N-A-L-Y-Z-E-R  A-U-T-O  S-Y-S-T-E-M
5/23/1980                                                     PAGE  2
                     PROGRAM LISTING FOR CFA19

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
0430 IF A$="R" THEN GOTO 1880
0440 PRINT
0450 PRINT "<7>INVALID RESPONSE"
0460 GOTO 0320
0470 REM  ----------------------------------------------------------------
0480 REM           TYPE OF TERMINAL
0490 PRINT
0500 PRINT "H = HELP"
0510 PRINT "T = TEKTRONIX 4000 SERIES"
0520 PRINT "P = HEWLETT/PACKARD 2647 OR 2648"
0530 PRINT "N = NEITHER OF THE ABOVE"
0540 PRINT
0550 ON ERR THEN GOTO 0570
0560 INPUT "TYPE OF TERMINAL ([H],T,P,N) >>  ",T$
0570 ON ERR THEN STOP
0580 IF T$="" THEN GOTO 0490
0590 IF T$="H" THEN GOTO 0490
0600 IF T$="T" THEN GOTO 0710
0610 IF T$="P" THEN GOTO 0710
0620 IF T$="N" THEN GOTO 0660
0630 PRINT
0640 PRINT "<7>INVALID RESPONSE"
0650 GOTO 0490
0660 PRINT
0670 PRINT "PLOTTING CANNOT BE DONE ON THIS TERMINAL"
0680 GOTO 0160
0690 REM  ----------------------------------------------------------------
0700 REM           BEGIN PLOTTING
0710 GOSUB 3250
0720 IF T$="T" THEN GOTO 0750
0730 PRINT "<27>H<27>J<27>&S1P0Q"
0740 ON ESC THEN GOTO 0130
0750 PRINT "<27><12>";
0760 DELAY =1
0770 PRINT "                           R-A-W   D-A-T-A   P-L-O-T"
0780 LET A3$="ANALYTE: #######
*       DATE: 00/00/00"
0790 LET A3$[68-LEN(STR$(SYS(2))),67]=STR$(SYS(2))
0800 LET A3$[71-LEN(STR$(SYS(1))),70]=STR$(SYS(1))
0810 LET A3$[74-LEN(STR$(SYS(3)-1900)),73]=STR$(SYS(3)-1900)
0820 PRINT USING A3$,A2$[A*7-6,A*7]
0830 REM  ----------------------------------------------------------------

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
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C-O-N-T-I-N-U-O-U-S  F-L-O-W  A-N-A-L-Y-Z-E-R  A-U-T-O  S-Y-S-T-E-M
5/23/1980                                                  PAGE  3
                     PROGRAM LISTING FOR CFA19

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
0840 REM          LABEL AND DRAW VERTICAL AXIS
0850 LET P1=0
0860 LET P2=0
0870 LET P3=0
0880 GOSUB 4250
0890 LET P2=670
0900 LET P3=3
0910 GOSUB 4250
0920 LET A3$="PH IN PERCENT FULL SCALE"
0930 FOR I=1 TO LEN(A3$)
0940   PRINT A3$[I,I]
0950 NEXT I
0960 FOR I=1 TO 6
0970   LET P2=128+(I-1)*108
0980   GOSUB 4250
0990   PRINT "<29>";P4$;"<31>";
1000   PRINT USING "####",(I-1)*20
1010 NEXT I
1020 LET Q1=63
1030 LET Q2=85
1040 LET Q3=12
1050 LET Q4=54
1060 LET Q5=1
1070 GOSUB 3890
1080 LET Q1=1013
1090 LET Q5=-1
1100 GOSUB 3890
1110 REM  ------------------------------------------------------------
1120 REM          LABEL AND DRAW HORIZONTAL AXIS
1130 LET P1=0
1140 LET P2=19
1150 LET P3=3
1160 GOSUB 4250
1170 PRINT "<29>";P4$;"<31>";
1180 PRINT "                           WHEEL POSITION"
1190 LET P1=0
1200 LET P2=55
1210 FOR I=F9 TO L9
1220   LET P1=P1+95
1230   GOSUB 4250
1240   PRINT "<29>";P4$;"<31>";
1250   LET A3$="000"

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
```

```
-O-N-T-I-N-U-O-U-S  F-L-O-W  A-N-A-L-Y-Z-E-R  A-U-T-O  S-Y-S-T-E-M
/23/1980                                                   PAGE  4
                     PROGRAM LISTING FOR CFA19

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
1260   LET A3$[4-LEN(STR$(I)),3]=STR$(I)
1270   PRINT A3$
1280 NEXT I
1290 LET Q1=63
1300 LET Q2=85
1310 LET Q3=10
1320 LET Q4=95
1330 LET Q5=2
1340 GOSUB 3890
1350 LET Q2=733
1360 LET Q5=-2
1370 GOSUB 3890
1380 REM  ------------------------------------------------------------
1390 REM           PLOT PEAKS
1400 LET P1=63
1410 LET P2=85
1420 LET P3=0
1430 GOSUB 4250
1440 LET Q3=60
1450 LET Q7=0
1460 FOR I=F9 TO L9
1470   MAT READ FILE[6,(I-1)*2*N+2*(A-1)+2],D2
1480   FOR J=1 TO 60
1490     LET P[J]=95*(I-F9)+17+J
1500     LET Q[J]=(D2[J]+10)*5.45833
1510     IF Q[J]<0 THEN LET Q[J]=0
1520     IF Q[J]>655 THEN LET Q[J]=655
1530   NEXT J
1540   LET P1=P[1]
1550   LET P2=Q[1]
1560   LET P3=3
1570   GOSUB 4250
1580   GOSUB 3720
1590 NEXT I
1600 FOR I=1 TO 4
1610   PRINT "<7>"
1620   DELAY =.3
1630 NEXT I
1640 TIME =120
1650 ON ERR THEN GOTO 1670
1660 TINPUT "",A$
1670 ON ERR THEN STOP

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         0         0         0         0         0         0         0
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C-O-N-T-I-N-U-O-U-S   F-L-O-W   A-N-A-L-Y-Z-E-R   A-U-T-O   S-Y-S-T-E-M
5/23/1980                                                          PAGE  5
                          PROGRAM LISTING FOR CFA19

 1234567891123456789212345678931234567894123456789512345678961234567897
          0         0         0         0         0         0         0
 1680 IF T$="T" THEN GOTO 1740
 1690 PRINT "<27>E"
 1700 DELAY =.7
 1710 ON ESC THEN GOTO 0160
 1720 PRINT "<27>H<27>J"
 1730 GOTO 1760
 1740 PRINT "<27><12>"
 1750 DELAY =1
 1760 ON ERR THEN GOTO 1780
 1770 INPUT "ANOTHER PLOT ([N],Y) >>  ",A$
 1780 ON ERR THEN STOP
 1790 IF A$="N" THEN GOTO 0160
 1800 IF A$="" THEN GOTO 0160
 1810 IF A$="Y" THEN GOTO 0710
 1820 PRINT
 1830 PRINT "<7>INVALID RESPONSE"
 1840 PRINT
 1850 GOTO 1770
 1860 REM    ------------------------------------------------------------
 1870 REM          GET REPORT PARAMETERS
 1880 GOSUB 3250
 1890 GOTO 1950
 1900 PRINT
 1910 PRINT "H = HELP"
 1920 PRINT "L = LINEPRINTER"
 1930 PRINT "T = TERMINAL"
 1940 PRINT "B = BOTH LINEPRINTER AND TERMINAL"
 1950 PRINT
 1960 ON ERR THEN GOTO 1980
 1970 INPUT "FORM OF RAW DATA REPORT ([H],L,T,B) >>  ",A$
 1980 ON ERR THEN STOP
 1990 IF A$="" THEN GOTO 1900
 2000 IF A$="H" THEN GOTO 1900
 2010 IF A$="L" THEN GOTO 2090
 2020 IF A$="T" THEN GOTO 2090
 2030 IF A$="B" THEN GOTO 2090
 2040 PRINT
 2050 PRINT "<7>INVALID RESPONSE"
 2060 GOTO 1900
 2070 REM    ------------------------------------------------------------
 2080 REM          CREATE REPORT
 2090 PRINT

 1234567891123456789212345678931234567894123456789512345678961234567897
          0         0         0         0         0         0         0
```

```
C-O-N-T-I-N-U-O-U-S   F-L-O-W   A-N-A-L-Y-Z-E-R   A-U-T-O   S-Y-S-T-E-M
5/23/1980                                                          PAGE  6
                          PROGRAM LISTING FOR CFA19

 1234567891123456789212345678931234567894123456789512345678961234567897
          0         0         0         0         0         0         0
 2100 PRINT "THE REPORT IS BEING PREPARED...";
 2110 OPEN FILE[0,1],"CFA000"
 2120 PRINT FILE[0],"                         R-A-W   D-A-T-A   R-E-P-O-R-
*     T"
 2130 LET A3$="                               DATE:  00/00/00"
 2140 LET A3$[40-LEN(STR$(SYS(2))),39]=STR$(SYS(2))
 2150 LET A3$[43-LEN(STR$(SYS(1))),42]=STR$(SYS(1))
 2160 LET A3$[46-LEN(STR$(SYS(3)-1900)),45]=STR$(SYS(3)-1900)
 2170 PRINT FILE[0],A3$
 2180 PRINT FILE[0]
 2190 PRINT FILE[0],"                              ANALYTE:  ";A2$[A*7-6
*     ,A*7]
 2200 PRINT FILE[0]
 2210 FOR I=F9 TO L9
 2220   READ FILE[6,(I-1)*2*N+2*(A-1)+1],H8,H9,P9,P7,Y,Z
 2230   PRINT FILE[0],USING "WHEEL POSITION: ###             ",I;
 2240   IF Y<>1 THEN GOTO 2270
 2250   PRINT FILE[0],"    ALGORITHM APPLIED: EXPECTED POSITION"
 2260   GOTO 2310
 2270   IF Y<>2 THEN GOTO 2300
 2280   PRINT FILE[0],"ALGORITHM APPLIED: HIGHEST LEVEL POSITION"
 2290   GOTO 2310
 2300   PRINT FILE[0],"                ALGORITHM APPLIED: NONE"
 2310   PRINT FILE[0],"PEAK HEIGHT: ";
 2320   IF Y<>1 THEN GOTO 2350
 2330   PRINT FILE[0],USING "---#.###",H8;
 2340   GOTO 2390
 2350   IF Y<>2 THEN GOTO 2380
 2360   PRINT FILE[0],USING "---#.###",H9;
 2370   GOTO 2390
 2380   PRINT FILE[0],"CBD      ";
 2390   IF Z<>-99999 THEN GOTO 2420
 2400   PRINT FILE[0],"                                TIMING ADJUSTMENT:
*     NONE"
 2410   GOTO 2430
 2420   PRINT FILE[0],USING "                        TIMING ADJUSTMENT: ++#
*     .# SECONDS",Z
 2430   PRINT FILE[0],"HIGHEST LEVEL POSITION:";
 2440   IF H9<>-99999 THEN GOTO 2470
 2450   PRINT FILE[0]," CBD";
 2460   GOTO 2480
 2470   PRINT FILE[0],USING " ## ",P9;

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          0         0         0         0         0         0         0
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C-O-N-T-I-N-U-O-U-S   F-L-O-W   A-N-A-L-Y-Z-E-R   A-U-T-O   S-Y-S-T-E-M
5/23/1980                                                            PAGE  7
                       PROGRAM LISTING FOR CFA19

 12345678911234567892123456789312345678941234567895123456789612345678970
          0         0         0         0         0         0         0
 2480   IF H9<>-99999 THEN GOTO 2510
 2490   PRINT FILE[0],"          HEIGHT AT HIGHEST LEVEL POSITION: CBD"
 2500   GOTO 2520
 2510   PRINT FILE[0],USING "    HEIGHT AT HIGHEST LEVEL POSITION: ---#
*     .###",H9
 2520   PRINT FILE[0],USING "EXPECTED POSITION: ##",P7;
 2530   IF H8<>-99999 THEN GOTO 2560
 2540   PRINT FILE[0],"                        HEIGHT AT EXPECTED POSITION:
*      CBD"
 2550   GOTO 2570
 2560   PRINT FILE[0],USING "                   HEIGHT AT EXPECTED POSITION
*     : ---#.###",H8
 2570   PRINT FILE[0]
 2580   PRINT FILE[0],"READING    RAW      SMOOTHED  STANDARD"
 2590   PRINT FILE[0],"NUMBER   READING    READING   DEVIATION"
 2600   PRINT FILE[0],"-------  --------  --------  ---------"
 2610   MAT READ FILE[6,(I-1)*2*N+2*(A-1)+2],D2
 2620   FOR J=1 TO 60
 2630     PRINT FILE[0],USING "   ##    ---#.###",J,D2[J];
 2640      IF J>=3 THEN IF J<=58 THEN GOTO 2670
 2650     PRINT FILE[0]
 2660     GOTO 2750
 2670     LET V=(D2[J-2]*(-3)+D2[J-1]*12+D2[J]*17+D2[J+1]*12+D2[J+2]*(-
*     3))/35
 2680     LET M=(D2[J-2]+D2[J-1][illegible]2[J]+D2[J+1]+D2[J+2])/5
 2690     LET R0=0
 2700     FOR K=-2 TO 2
 2710       LET R0=R0+(D2[J+K]-M)^2
 2720     NEXT K
 2730     LET G2=SQR(R0/4)
 2740     PRINT FILE[0],USING "  ---#.###  ####.###",V,G2
 2750   NEXT J
 2760   PRINT FILE[0]
 2770   PRINT FILE[0]
 2780   PRINT FILE[0]
 2790   PRINT ".";
 2800 NEXT I
 2810 PRINT
 2820 CLOSE FILE[0]
 2830 IF A$<>"T" THEN IF A$<>"B" THEN GOTO 2960
 2840 OPEN FILE[0,3],"CFA000"
 2850 FOR I=1 TO 5

 12345678911234567892123456789312345678941234567895123456789612345678970
          0         0         0         0         0         0         0
```

```
C-O-N-T-I-N-U-O-U-S   F-L-O-W   A-N-A-L-Y-Z-E-R   A-U-T-O   S-Y-S-T-E-M
5/23/1980                                                            PAGE  8
                       PROGRAM LISTING FOR CFA19

 12345678911234567892123456789312345678941234567895123456789612345678970
          0         0         0         0         0         0         0
 2860   PRINT
 2870 NEXT I
 2880 LREAD FILE[0],A3$,A9$
 2890 IF EOF(0) THEN GOTO 2920
 2900 PRINT A3$;A9$;
 2910 GOTO 2880
 2920 CLOSE FILE[0]
 2930 FOR I=1 TO 5
 2940   PRINT
 2950 NEXT I
 2960 IF A$<>"L" THEN IF A$<>"B" THEN GOTO 3220
 2970 PRINT "THE REPORT IS BEING SENT TO THE LINEPRINTER...";
 2980 OPEN FILE[0,3],"CFA000"
 2990 ON ERR THEN GOTO 3030
 3000 OPEN FILE[7,1],"$LPT"
 3010 ON ERR THEN STOP
 3020 GOTO 3080
 3030 ON ERR THEN STOP
 3040 PRINT
 3050 PRINT "THE LINEPRINTER IS IN USE;  THERE WILL BE A 10-SECOND DELA
*     Y"
 3060 DELAY =10
 3070 GOTO 2990
 3080 LET X8=0
 3090 LREAD FILE[0],A3$,A9$
 3100 IF EOF(0) THEN GOTO 3190
 3110 IF A9$="<13>" THEN LET X8=X8+1
 3120 LET A3$=A3$,A9$
 3130 PRINT FILE[7],A3$;
 3140 IF X8<>63 THEN GOTO 3090
 3150 PRINT FILE[7],"<12>"
 3160 LET X8=0
 3170 PRINT ".";
 3180 GOTO 3090
 3190 CLOSE FILE[7]
 3200 CLOSE FILE[0]
 3210 PRINT
 3220 GOTO 0160
 3230 REM    ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
 3240 REM            SUBROUTINE TO GET ANALYTE AND WHEEL POSITIONS
 3250 IF N<>1 THEN GOTO 3330
 3260 LET A=1

 12345678911234567892123456789312345678941234567895123456789612345678970
          0         0         0         0         0         0         0
```

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(4-76)

```
C-O-N-T-I-N-U-O-U-S  F-L-O-W  A-N-A-L-Y-Z-E-R  A-U-T-O  S-Y-S-T-E-M
5/23/1980                                                    PAGE  9
                     PROGRAM LISTING FOR CFA19

 1234567891123456789212345678931234567894123456789512345678961234567897
          0         0         0         0         0         0         0
 3270 GOTO 3500
 3280 PRINT
 3290 PRINT "H = HELP"
 3300 FOR I=1 TO N
 3310   PRINT USING "# = #######",I,A2$[I*7-6,I*7]
 3320 NEXT I
 3330 PRINT
 3340 PRINT "ANALYTE ([H]";
 3350 FOR I=1 TO N
 3360   PRINT USING ",#",I;
 3370 NEXT I
 3380 ON ERR THEN GOTO 3400
 3390 INPUT ") >>  ",A$
 3400 ON ERR THEN STOP
 3410 IF A$="" THEN GOTO 3280
 3420 IF A$="H" THEN GOTO 3280
 3430 IF A$="1" THEN GOTO 3490
 3440 IF A$="2" THEN GOTO 3490
 3450 IF A$="3" THEN IF N=3 THEN GOTO 3490
 3460 PRINT
 3470 PRINT "<7>INVALID RESPONSE"
 3480 GOTO 3280
 3490 LET A=VAL(A$)
 3500 PRINT
 3510 ON ERR THEN GOTO 3530
 3520 INPUT "FIRST WHEEL POSITION TO BE INCLUDED >>  ",F9
 3530 ON ERR THEN STOP
 3540 IF F9=INT(F9) THEN IF F9>0 THEN IF F9<=W7 THEN GOTO 3580
 3550 PRINT
 3560 PRINT "<7>INVALID RESPONSE"
 3570 GOTO 3430
 3580 PRINT
 3590 ON ERR THEN GOTO 3610
 3600 INPUT "LAST WHEEL POSITION TO BE INCLUDED >>  ",L9
 3610 ON ERR THEN STOP
 3620 IF L9=INT(L9) THEN IF L9>0 THEN IF L9<=W7 THEN IF L9>=F9 THEN GOT
*     0 3660
 3630 PRINT
 3640 PRINT "<7>INVALID RESPONSE"
 3650 GOTO 3580
 3660 IF L9<=F9+9 THEN RETURN
 3670 PRINT

 1234567891123456789212345678931234567894123456789512345678961234567897
          0         0         0         0         0         0         0
```

```
C-O-N-T-I-N-U-O-U-S  F-L-O-W  A-N-A-L-Y-Z-E-R  A-U-T-O  S-Y-S-T-E-M
5/23/1980                                                    PAGE 10
                     PROGRAM LISTING FOR CFA19

 1234567891123456789212345678931234567894123456789512345678961234567897
          0         0         0         0         0         0         0
 3680 PRINT "<7>INVALID RESPONSE; LIMIT OF 10 WHEEL POSITIONS EXCEEDED"
 3690 GOTO 3500
 3700 REM   +++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
 3710 REM          SUBROUTINE TO DRAW LINES AND CURVES (BSCLIN.SR)
 3720 LET Q8=0
 3730 LET P3=3
 3740 IF Q7>=0 THEN LET P3=2
 3750 FOR Q9=1 TO Q3
 3760   LET P1=P[Q9]
 3770   LET P2=Q[Q9]
 3780   GOSUB 4250
 3790   LET Q8=Q8+1
 3800   IF Q8<>ABS(Q7) THEN GOTO 3850
 3810   LET U1=P[Q9]
 3820   LET U2=Q[Q9]
 3830   REM GOSUB TO BSCMKR.SR HAS BEEN REMOVED HERE
 3840   LET Q8=0
 3850 NEXT Q9
 3860 RETURN
 3870 REM   +++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
 3880 REM          SUBROUTINE TO DRAW AXES (BSCAXS.SR)
 3890 LET P1=Q1
 3900 LET P2=Q2
 3910 LET P3=3
 3920 GOSUB 4250
 3930 LET P3=2
 3940 IF ABS(Q5)=1 THEN GOTO 4040
 3950 FOR Q6=1 TO Q3+1
 3960   GOSUB 4250
 3970   LET P2=P2+10*Q5/ABS(Q5)
 3980   GOSUB 4250
 3990   LET P2=P2-10*Q5/ABS(Q5)
 4000   GOSUB 4250
 4010   LET P1=P1+Q4
 4020 NEXT Q6
 4030 RETURN
 4040 FOR Q6=1 TO Q3+1
 4050   GOSUB 4250
 4060   LET P1=P1+10*Q5/ABS(Q5)
 4070   GOSUB 4250
 4080   LET P1=P1-10*Q5/ABS(Q5)
 4090   GOSUB 4250

 1234567891123456789212345678931234567894123456789512345678961234567897
          0         0         0         0         0         0         0
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EPA-287 (Cin.)
(4-76)

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C-O-N-T-I-N-U-O-U-S   F-L-O-W   A-N-A-L-Y-Z-E-R   A-U-T-O   S-Y-S-T-E-M
5/23/1980                                                          PAGE 11
                       PROGRAM LISTING FOR CFA19

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
4100   LET P2=P2+Q4
4110 NEXT Q6
4120 RETURN
4130 REM    +++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
4140 REM           SUBROUTINE TO PLOT INDIVIDUAL POINTS
4150 DIM P1$[32],P2$[32],P3$[32],P4$[4]
4160 LET P4=0
4170 LET P5=0
4180 LET P6=0
4190 LET P1$=" !<34>#$%&'()*+,-./0123456789:;<=>?"
4200 LET P2$="@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_"
4210 LET P3$="`ABCDEFGHIJKLM"
4220 LET P3$=P3$,"NOPQRSTUVWXY"
4230 LET P3$=P3$,"Z[\]^^"
4240 RETURN
4250 IF P3<>0 THEN GOTO 4290
4260 LET P4=P1
4270 LET P5=P2
4280 RETURN
4290 PRINT "<29>";
4300 IF LEN(P4$)<>0 THEN PRINT P4$[4,4];
4310 LET P7=INT(P1+P4)
4320 LET P8=INT(P2+P5)
4330 IF ?7>1023 THEN LET P7=1023
4340 IF P7<0 THEN LET P7=0
4350 IF P8>780 THEN LET P8=780
4360 IF P8<0 THEN LET P8=0
4370 IF P3=2 THEN LET P6=1
4380 IF P3=3 THEN LET P6=0
4390 LET P9=INT(P8/32)
4400 LET P8=P8-(P9*32)+1
4410 LET P9=P9+1
4420 LET P4$=P1$[P9,P9],P3$[P8,P8]
4430 LET P9=INT(P7/32)
4440 LET P7=P7-(P9*32)+1
4450 LET P9=P9+1
4460 LET P4$=P4$,P1$[P9,P9],P2$[P7,P7]
4470 IF P6<>0 THEN GOTO 4490
4480 PRINT "<29>";
4490 PRINT P4$
4500 RETURN


1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
```

```
:-O-N-T-I-N-U-O-U-S   F-L-O-W   A-N-A-L-Y-Z-E-R   A-U-T-O   S-Y-S-T-E-M
i/23/1980                                                          PAGE 12
                         SYMBOL TABLE FOR CFA19

SYMBOL     REFERENCES
------   --------------------------------------------------------------
 0130    0740
 0160    0100  0270  0680  1710  1790  1800  3220
 0190    0120
 0240    0200
 0280    0230
 0320    0400  0410  0460
 0360    0310
 0390    0370
 0490    0580  0590  0650
 0540    0420
 0570    0550
 0660    0620
 0710    0600  0610  1810
 0750    0720
 1670    1650
 1740    1680
 1760    1730
 1770    1850
 1780    1760
 1880    0430
 1900    1990  2000  2060
 1950    1890
 1980    1960
 2090    2010  2020  2030
 2270    2240
 2300    2270
 2310    2260  2290
 2350    2320
 2380    2350
 2390    2340  2370
 2420    2390
 2430    2410
 2470    2440
 2480    2460
 2510    2480
 2520    2500
 2560    2530
 2570    2550
 2670    2640
 2750    2660
 2880    2910
 2920    2890
 2960    2830
 2990    3070
 3030    2990
```

AND ILLUSTRATIONS

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C-O-N-T-I-N-U-O-U-S   F-L-O-W   A-N-A-L-Y-Z-E-R   A-U-T-O   S-Y-S-T-E-M
5/23/1980                                                        PAGE 13
                        SYMBOL TABLE FOR CFA19

SYMBOL    REFERENCES
------  ----------------------------------------------------------------

 3080   3020
 3090   3140  3180
 3190   3100
 3220   2960
 3250   0710  1880
 3280   3410  3420  3480
 3330   3250
 3400   3380
 3430   3570
 3490   3430  3440  3450
 3500   3270  3690
 3530   3510
 3580   3540  3650
 3610   3590
 3660   3620
 3720   1580
 3850   3800
 3890   1070  1100  1340  1370
 4040   3940
 4150   0090
 4250   0880  0910  0980  1160  1230  1430  1570  3780  3920  3960
        3980  4000  4050  4070  4090
 4290   4250
 4490   4470
 A      0820  1470  2190  2220  2610  3260  3490
 A$     0190  0380  0400  0410  0420  0430  1660  1770  1790  1800
        1810  1970  1990  2000  2010  2020  2030  2830  2960  3390
        3410  3420  3430  3440  3450  3490
 A2$    0190  0280  0820  2190  3310
 A3$    0190  0780  0790  0800  0810  0820  0920  0930  0940  1250
        1260  1270  2130  2140  2150  2160  2170  2880  2900  3090
        3120  3130
 A9$    2880  2900  3090  3110  3120
 D2     1470  2610
 D2[    0190  1500  2630  2670  2680  2710
 F9     1210  1460  1490  2210  3520  3540  3620  3660
 FL#0   2110  2120  2170  2180  2190  2200  2230  2250  2280  2300
        2310  2330  2360  2380  2400  2420  2430  2450  2470  2490
        2510  2520  2540  2560  2570  2580  2590  2600  2630  2650
        2740  2760  2770  2780  2820  2840  2880  2920  2980  3090
        3200
 FL#6   0210  0280  1470  2220  2610
 FL#7   3000  3130  3150  3190
 G2     2730  2740
 H8     2220  2330  2530  2560
```

```
C-O-N-T-I-N-U-O-U-S   F-L-O-W   A-N-A-L-Y-Z-E-R   A-U-T-O   S-Y-S-T-E-M
5/23/1980                                                        PAGE 14
                        SYMBOL TABLE FOR CFA19

SYMBOL    REFERENCES
------  ----------------------------------------------------------------

 H9     2220  2360  2440  2480  2510
 I      0930  0940  0950  0960  0970  1000  1010  1210  1260  1280
        1460  1470  1490  1590  1600  1630  2210  2220  2230  2610
        2800  2850  2870  2930  2950  3300  3310  3320  3350  3360
        3370
 J      1480  1490  1500  1510  1520  1530  2620  2630  2640  2670
        2680  2710  2750
 K      2700  2710  2720
 L9     1210  1460  2210  3600  3620  3660
 M      2680  2710
 N      0280  1470  2220  2610  3250  3300  3350  3450
 P1     0850  1130  1190  1220  1400  1540  3760  3890  4010  4060
        4080  4260  4310
 P1$    4150  4190  4420  4460
 P2     0860  0890  0970  1140  1200  1410  1550  3770  3900  3970
        3990  4100  4270  4320
 P2$    4150  4200  4460
 P3     0870  0900  1150  1420  1560  3730  3740  3910  3930  4250
        4370  4380
 P3$    4150  4210  4220  4230  4420
 P4     4160  4260  4310
 P4$    0990  1170  1240  4150  4300  4420  4460  4490
 P5     4170  4270  4320
 P6     4180  4370  4380  4470
 P7     2220  2520  4310  4330  4340  4430  4440  4460
 P8     4320  4350  4360  4390  4400  4420
 P9     2220  2470  4390  4400  4410  4420  4430  4440  4450  4460
 P[     0190  1490  1540  3760  3810
 Q1     1020  1080  1290  3890
 Q2     1030  1300  1350  3900
 Q3     1040  1310  1440  3750  3950  4040
 Q4     1050  1320  4010  4100
 Q5     1060  1090  1330  1360  3940  3970  3990  4060  4080
 Q6     3950  4020  4040  4110
 Q7     1450  3740  3800
 Q8     3720  3790  3800  3840
 Q9     3750  3760  3770  3810  3820  3850
 Q[     0190  1500  1510  1520  1550  3770  3820
 R0     2690  2710  2730
 T$     0190  0560  0580  0590  0600  0610  0620  0720  1680
 U1     3810
 U2     3820
 V      2670  2740
 W7     0280  0300  3540  3620
 X8     3080  3110  3140  3160
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EPA-287 (Cin.)
(4-76)

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C-O-N-T-I-N-U-O-U-S   F-L-O-W   A-N-A-L-Y-Z-E-R   A-U-T-O   S-Y-S-T-E-M
5/23/1980                                                        PAGE 15
                          SYMBOL TABLE FOR CFA19

SYMBOL    REFERENCES
------   ---------------------------------------------------------------
Y         2220  2240  2270  2320  2350
Z         2220  2390  2420
```

EPA-287 (Cin.)
(4-76)

SECTION 22

PROGRAM CFA20 - SECOND TERMINAL CALIBRATION REPORTER/PLOTTER

CFA20 is the program which creates the second-terminal calibration report/plot. It is entered by chaining from INITIALIZE.2. It logs the user off from the computer if the ESCAPE key is pressed.

CFA20 is essentially the same program as CFA12. The only major differences are that this program reads all of the necessary data from file CFA006, and that this program logs the user off from the computer at the end of the session. Furthermore, all of the input statements in this program are timed so that if a user leaves the terminal, the program will soon log off from the computer automatically.

One additional symbol is used in CFA20. It is R1, the number of standards listed in file CFA006 for analytes before the current analyte.

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C-O-N-T-I-N-U-O-U-S  F-L-O-W  A-N-A-L-Y-Z-E-R  A-U-T-O  S-Y-S-T-E-M
5/23/1980                                                    PAGE  1
                     PROGRAM LISTING FOR CFA20

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
0010 REM  +=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+
0020 REM  +   CONTINUOUS FLOW ANALYZER AUTOMATION SYSTEM               +
0030 REM  +   PROGRAM CFA20, 2ND-TERMINAL CALIB. REPORTER/PLOTTER      +
0040 REM  +   BY:  J. KOPKE (UCCC)     FEBRUARY 29, 1980               +
0050 REM  +   MOST RECENT REVISION:  APRIL 15, 1980                    +
0060 REM  +=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+=+
0070 REM
0080 PAGE =132
0090 DIM A2$[21],T$[1],A$[1],M[4],A3$[79],P[52],Q[52],I5[2,20],U$[3]
0100 GOSUB 3700
0110 ON ESC THEN GOTO 0170
0120 ESC
0130 GOTO 0220
0140 PRINT "<27>E"
0150 DELAY =.7
0160 PRINT "<27>H<27>J"
0170 NOESC
0180 PRINT
0190 PRINT "YOU ARE BEING LOGGED OFF FROM THE COMPUTER"
0200 CLOSE
0210 BYE
0220 ON ERR THEN GOTO 0240
0230 RENAME "CFA006","CFA006"
0240 ON ERR THEN STOP
0250 IF SYS(7)<>-48 THEN GOTO 0300
0260 PRINT
0270 PRINT "<7>THE SECOND-TERMINAL CALIBRATION REPORT/PLOT FEATURE CAN
*     NOT BE USED AT"
0280 PRINT "THIS MOMENT BECAUSE THE MAIN SYSTEM IS CURRENTLY PERFORMIN
*     G CALIBRATION"
0290 GOTO 0170
0300 IF SYS(7)<>-10 THEN GOTO 0350
0310 PRINT
0320 PRINT "<7>THE SECOND-TERMINAL CALIBRATION REPORT/PLOT FEATURE CAN
*     NOT BE USED AT"
0330 PRINT "THIS MOMENT BECAUSE THERE IS NO CALIBRATION DATA AVAILABLE
*     "
0340 GOTO 0170
0350 ON ERR THEN GOTO 0390
0360 OPEN FILE[7,0],"CFA006",26
0370 ON ERR THEN STOP
0380 GOTO 0460

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
```

```
C-O-N-T-I-N-U-O-U-S  F-L-O-W  A-N-A-L-Y-Z-E-R  A-U-T-O  S-Y-S-T-E-M
5/23/1980                                                    PAGE  2
                     PROGRAM LISTING FOR CFA20

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
0390 ON ERR THEN STOP
0400 GOTO 0220
0410 PRINT
0420 PRINT "H = HELP"
0430 PRINT "T = TEKTRONIX 4000 SERIES"
0440 PRINT "P = HEWLETT-PACKARD 2647 OR 2648"
0450 PRINT "N = NEITHER OF THE ABOVE"
0460 PRINT
0470 PRINT "TERMINAL TYPE ([H],T,P,N) >>  ";
0480 TIME =300
0490 ON ERR THEN GOTO 0530
0500 TINPUT "",T$
0510 ON ERR THEN STOP
0520 GOTO 0590
0530 ON ERR THEN STOP
0540 IF SYS(7)<>60 THEN GOTO 0590
0550 PRINT
0560 PRINT
0570 PRINT "NO RESPONSE IN 5 MINUTES;"
0580 GOTO 0170
0590 IF T$="" THEN GOTO 0410
0600 IF T$="H" THEN GOTO 0410
0610 IF T$="T" THEN GOTO 0670
0620 IF T$="P" THEN GOTO 0670
0630 IF T$="N" THEN GOTO 0670
0640 PRINT
0650 PRINT "<7>INVALID RESPONSE"
0660 GOTO 0410
0670 READ FILE[7,0],N,A2$
0680 DIM K5[N],S7[N],F5[N],F6[N]
0690 MAT READ FILE[7,1],K5
0700 MAT READ FILE[7,2],S7
0710 MAT READ FILE[7,3],F5
0720 MAT READ FILE[7,4],F6
0730 READ FILE[7,5],D3,D4,D5,U$
0740 IF N<>1 THEN GOTO 0820
0750 LET A=1
0760 GOTO 1060
0770 PRINT
0780 PRINT "H = HELP"
0790 FOR I=1 TO N
0800    PRINT USING "# = #######",I,A2$[I*7-6,I*7]

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
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C-O-N-T-I-N-U-O-U-S  F-L-O-W  A-N-A-L-Y-Z-E-R  A-U-T-O  S-Y-S-T-E-M
5/23/1980                                                  PAGE  3
                    PROGRAM LISTING FOR CFA20

123456789112345678921234567893123456789412345678951234567896123456789 7
         0         0         0         0         0         0         0
0810 NEXT I
0820 PRINT
0830 PRINT "ANALYTE ([H]";
0840 FOR I=1 TO N
0850   PRINT USING ",#",I;
0860 NEXT I
0870 PRINT ") >>  ";
0880 TIME =300
0890 ON ERR THEN GOTO 0930
0900 TINPUT "",A$
0910 ON ERR THEN STOP
0920 GOTO 0950
0930 ON ERR THEN STOP
0940 IF SYS(7)=60 THEN GOTO 0550
0950 IF A$="" THEN GOTO 0770
0960 IF A$="H" THEN GOTO 0770
0970 IF A$="1" THEN GOTO 1030
0980 IF A$="2" THEN GOTO 1030
0990 IF N=3 THEN IF A$="3" THEN GOTO 1030
1000 PRINT
1010 PRINT "<7>INVALID RESPONSE"
1020 GOTO 0770
1030 LET A=VAL(A$)
1040 REM    ---------------------------------------------------------
1050 REM              PRINT CALIBRATION REPORT
1060 IF T$="N" THEN GOTO 1130
1070 IF T$="T" THEN GOTO 1100
1080 PRINT "<27>H<27>J<27>&S1P0Q"
1090 ON ESC THEN GOTO 0140
1100 PRINT "<27><12>";
1110 DELAY =1
1120 GOTO 1160
1130 FOR I=1 TO 5
1140   PRINT
1150 NEXT I
1160 PRINT "                       C-A-L-I-B-R-A-T-I-O-N   R-E-P-O-R-T"
1170 LET A3$="ANALYTE: #######                                DATE OF CALI
#    BRATION: 00/00/00"
1180 LET A3$[68-LEN(STR$(D3)),67]=STR$(D3)
1190 LET A3$[71-LEN(STR$(D4)),70]=STR$(D4)
1200 LET A3$[74-LEN(STR$(D5)),73]=STR$(D5)
1210 PRINT USING A3$,A2$[A*7-6,A*7]

123456789112345678921234567893123456789412345678951234567896123456789 7
         0         0         0         0         0         0         0
```

```
C-O-N-T-I-N-U-O-U-S  F-L-O-W  A-N-A-L-Y-Z-E-R  A-U-T-O  S-Y-S-T-E-M
5/23/1980                                                  PAGE  4
                    PROGRAM LISTING FOR CFA20

123456789112345678921234567893123456789412345678951234567896123456789 7
         0         0         0         0         0         0         0
1220 PRINT USING "DEGREE: #   FITTING ERROR: ###.##%   FORCED ORIGIN F
#    ITTING ERROR: ###.##%",K5[A],F5[A],F6[A]
1230 IF K5[A]=0 THEN GOTO 1300
1240 MAT READ FILE[7,5+A],M
1250 PRINT USING "CONC = +#.##^^^^  +#.##^^^^ *BCPH",M[1],M[2];
1260 IF K5[A]<2 THEN GOTO 1300
1270 PRINT USING "  +#.##^^^^ *BCPH^2",M[3];
1280 IF K5[A]<3 THEN GOTO 1300
1290 PRINT USING "  +#.##^^^^ *BCPH^3",M[4];
1300 PRINT
1310 LET R1=0
1320 IF A>1 THEN LET R1=R1+S7[1]
1330 IF A>2 THEN LET R1=R1+S7[2]
1340 FOR I=1 TO S7[A]
1350   READ FILE[7,5+N+R1+I],I5[1,I],I5[2,I]
1360 NEXT I
1370 PRINT
1380 PRINT "          TCONC     CONC      DIFF"
1390 PRINT "        -------   -------   -------"
1400 FOR I=1 TO S7[A]
1410   IF K5[A]<>0 THEN GOTO 1440
1420   LET C=I5[2,I]
1430   GOTO 1450
1440   LET C=M[1]+I5[1,I]*M[2]+I5[1,I]^2*M[3]+I5[1,I]^3*M[4]
1450   PRINT USING "          ---#.### ---#.### ---#.###",I5[2,I],C,I5[
#    2,I]-C
1460 NEXT I
1470 IF T$="N" THEN GOTO 2990
1480 REM    ---------------------------------------------------------
1490 REM              LABEL AND DRAW VERTICAL AXIS
1500 LET P1=0
1510 LET P2=0
1520 LET P3=0
1530 GOSUB 4230
1540 LET P2=670
1550 LET P3=3
1560 GOSUB 4230
1570 LET A3$="BCPH IN PERCENT FULL SCALE"
1580 FOR I=1 TO LEN(A3$)
1590   PRINT A3$[I,I]
1600 NEXT I
1610 FOR I=1 TO 6

123456789112345678921234567893123456789412345678951234567896123456789 7
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AND ILLUSTRATIONS
EPA-287 (Cin.)
(4-76)

```
C-O-N-T-I-N-U-O-U-S  F-L-O-W  A-N-A-L-Y-Z-E-R  A-U-T-O  S-Y-S-T-E-M
5/23/1980                                                     PAGE 5
                       PROGRAM LISTING FOR CFA20

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
1620   LET P2=74+(I-1)*121
1630   IF I=1 THEN LET P2=P2+8
1640   IF I=6 THEN LET P2=P2-5
1650   GOSUB 4230
1660   PRINT "<29>";P4$;"<31>";
1670   PRINT USING "####",(I-1)*20
1680 NEXT I
1690 LET Q1=63
1700 LET Q2=85
1710 LET Q3=5
1720 LET Q4=121
1730 LET Q5=1
1740 GOSUB 3870
1750 LET Q1=998
1760 LET Q5=-1
1770 GOSUB 3870
1780 REM  -----------------------------------------------------------------
1790 REM          LABEL AND DRAW HORIZONTAL AXIS
1800 LET P1=0
1810 LET P2=19
1820 LET P3=3
1830 GOSUB 4230
1840 PRINT "<29>";P4$;"<31>";
1850 PRINT "                    CONCENTRATION IN ";U$[A,A];"G/L"
1860 LET S1=0
1870 LET S2=0
1880 FOR I=1 TO S7[A]
1890   IF I5[2,I]>S2 THEN LET S2=I5[2,I]
1900 NEXT I
1910 GOSUB 3230
1920 LET X5=S[1]
1930 LET X6=S[12]
1940 LET A3$="#.###"
1950 IF S[12]>=10 THEN LET A3$="##.##"
1960 IF S[12]>=100 THEN LET A3$="###.#"
1970 IF S[12]>=1000 THEN LET A3$="#####"
1980 LET P2=55
1990 FOR I=1 TO 12
2000   LET P1=28+(I-1)*85
2010   GOSUB 4230
2020   PRINT "<29>";P4$;"<31>";
2030   PRINT USING A3$,S[I]

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
```

```
C-O-N-T-I-N-U-O-U-S  F-L-O-W  A-N-A-L-Y-Z-E-R  A-U-T-O  S-Y-S-T-E-M
5/23/1980                                                     PAGE 6
                       PROGRAM LISTING FOR CFA20

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
2040 NEXT I
2050 LET Q1=63
2060 LET Q2=85
2070 LET Q3=11
2080 LET Q4=85
2090 LET Q5=2
2100 GOSUB 3870
2110 LET Q2=690
2120 LET Q5=-2
2130 GOSUB 3870
2140 REM  -----------------------------------------------------------------
2150 REM          PUT STANDARDS IN ORDER
2160 FOR J=S7[A] TO 2 STEP -1
2170   FOR K=2 TO J
2180     IF I5[1,K-1]<=I5[1,K] THEN GOTO 2250
2190     LET Z3=I5[1,K]
2200     LET Z4=I5[2,K]
2210     LET I5[1,K]=I5[1,K-1]
2220     LET I5[2,K]=I5[2,K-1]
2230     LET I5[1,K-1]=Z3
2240     LET I5[2,K-1]=Z4
2250   NEXT K
2260 NEXT J
2270 REM  -----------------------------------------------------------------
2280 REM          MARK STANDARDS -- CONNECT FOR INTERPOLATION ONLY
2290 LET P1=63
2300 LET P2=85
2310 LET P3=0
2320 GOSUB 4230
2330 LET P5$="O<8>+"
2340 FOR I=1 TO S7[A]
2350   LET P[I]=935*(I5[2,I]-X5)/(X6-X5)
2360   LET Q[I]=605*I5[1,I]/100
2370 NEXT I
2380 LET Q3=S7[A]
2390 LET Q7=-1
2400 IF K5[A]<>0 THEN GOTO 2460
2410 LET Q7=1
2420 LET P1=0
2430 LET P2=0
2440 LET P3=3
2450 GOSUB 4230

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C-O-N-T-I-N-U-O-U-S  F-L-O-W  A-N-A-L-Y-Z-E-R  A-U-T-O  S-Y-S-T-E-M
5/23/1980                                                    PAGE  7
                     PROGRAM LISTING FOR CFA20

 1234567891123456789212345678931234567894123456789512345678961234567897
          0         0         0         0         0         0         0
 2460 GOSUB 3530
 2470 IF K5[A]<>0 THEN GOTO 2630
 2480 LET P1=P[S7[A]]
 2490 LET P2=Q[S7[A]]
 2500 LET P3=3
 2510 GOSUB 4230
 2520 LET P1=935
 2530 LET P2=(Q[S7[A]]-Q[S7[A]-1])/(P[S7[A]]-P[S7[A]-1])*(935-P[S7[A]-1
*      ])+Q[S7[A]-1]
 2540 IF P2<=605 THEN GOTO 2580
 2550 LET P2=605
 2560 LET P1=(P[S7[A]]-P[S7[A]-1])/(Q[S7[A]]-Q[S7[A]-1])*(605-Q[S7[A]-1
*      ])+P[S7[A]-1]
 2570 IF P1>935 THEN GOTO 2810
 2580 LET P3=2
 2590 GOSUB 4230
 2600 GOTO 2810
 2610 REM    ----------------------------------------------------------
 2620 REM           DRAW CURVE
 2630 LET Q3=1
 2640 FOR I=0 TO 100 STEP 2
 2650   LET Q[Q3]=605*I/100
 2660   LET C=M[1]+I*M[2]+I^2*M[3]+I^3*M[4]
 2670   LET P[Q3]=935*(C-X5)/(X6-X5)
 2680   IF P[Q3]<0 THEN GOTO 2710
 2690   IF P[Q3]>935 THEN GOTO 2710
 2700   LET Q3=Q3+1
 2710 NEXT I
 2720 LET Q3=Q3-1
 2730 LET P1=P[1]
 2740 LET P2=Q[1]
 2750 LET P3=3
 2760 GOSUB 4230
 2770 LET Q7=0
 2780 GOSUB 3530
 2790 REM    ----------------------------------------------------------
 2800 REM           SOUND BELL -- ALLOW TIME FOR HARD COPY
 2810 FOR I=1 TO 4
 2820   PRINT "<7>"
 2830   DELAY =.3
 2840 NEXT I
 2850 TIME =120

 1234567891123456789212345678931234567894123456789512345678961234567897
          0         0         0         0         0         0         0
```

```
C-O-N-T-I-N-U-O-U-S  F-L-O-W  A-N-A-L-Y-Z-E-R  A-U-T-O  S-Y-S-T-E-M
5/23/1980                                                    PAGE  8
                     PROGRAM LISTING FOR CFA20

 1234567891123456789212345678931234567894123456789512345678961234567897
          0         0         0         0         0         0         0
 2860 ON ERR THEN GOTO 2880
 2870 TINPUT "",A$
 2880 ON ERR THEN STOP
 2890 PRINT "<27><12>"
 2900 DELAY =1
 2910 IF T$<>"P" THEN GOTO 2980
 2920 PRINT "<27>E"
 2930 DELAY =.7
 2940 ON ESC THEN GOTO 0170
 2950 PRINT "<27>H<27>J"
 2960 REM    ----------------------------------------------------------
 2970 REM           WRAP-UP PROCEDURE
 2980 GOTO 3020
 2990 FOR I=1 TO 5
 3000   PRINT
 3010 NEXT I
 3020 PRINT "ANOTHER REPORT ([N],Y) >>  ";
 3030 TIME =300
 3040 ON ERR THEN GOTO 3080
 3050 TINPUT "",A$
 3060 ON ERR THEN STOP
 3070 GOTO 3140
 3080 ON ERR THEN STOP
 3090 IF SYS(7)<>60 THEN GOTO 3140
 3100 PRINT
 3110 PRINT
 3120 PRINT "NO RESPONSE IN 5 MINUTES HAS IMPLIED AN ANSWER OF 'N';"
 3130 GOTO 0170
 3140 IF A$="" THEN GOTO 0170
 3150 IF A$="N" THEN GOTO 0170
 3160 IF A$="Y" THEN GOTO 0740
 3170 PRINT
 3180 PRINT "<7>INVALID RESPONSE"
 3190 PRINT
 3200 GOTO 2980
 3210 REM    ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
 3220 REM           SUBROUTINE TO PERFORM SCALING (BSCSCL.SR)
 3230 DIM S[12]
 3240 LET S7=0
 3250 LET S3=S2-S1
 3260 IF S3>=100 THEN GOTO 3310
 3270 LET S1=S1*10

 1234567891123456789212345678931234567894123456789512345678961234567897
          0         0         0         0         0         0         0
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EPA-287 (Cin.)
(4-76)

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C-O-N-T-I-N-U-O-U-S  F-L-O-W  A-N-A-L-Y-Z-E-R  A-U-T-O  S-Y-S-T-E-M
5/23/1980                                                    PAGE  9
                        PROGRAM LISTING FOR CFA20

 1234567891123456789212345678931234567894123456789512345678961234567897
          0         0         0         0         0         0         0
 3280 LET S2=S2*10
 3290 LET S7=S7+1
 3300 GOTO 3250
 3310 LET S4=0
 3320 IF S3<100 THEN GOTO 3360
 3330 LET S3=S3/10
 3340 LET S4=S4+1
 3350 GOTO 3320
 3360 IF S1=0 THEN IF S3-10*INT(S3/10)<=INT(S3/10) THEN LET S3=10*INT(S
*      3/10)
 3370 LET S3=INT(S3+.5)
 3380 IF S3-10*INT(S3/10)=0 THEN GOTO 3420
 3390 IF S3-10*INT(S3/10)=5 THEN GOTO 3420
 3400 LET S3=S3+1
 3410 GOTO 3380
 3420 LET S5=S3*10^(S4-1)
 3430 LET S1=INT(S1/10^(S4-1))*10^(S4-1)
 3440 IF S1/S5=INT(S1/S5) THEN GOTO 3470
 3450 LET S1=S1-10^(S4-1)
 3460 GOTO 3440
 3470 FOR S6=1 TO 12
 3480   LET S[S6]=(S1+(S6-1)*S5)/10^(S7)
 3490 NEXT S6
 3500 RETURN
 3510 REM    ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
 3520 REM          SUBROUTINE TO DRAW LINES AND CURVES (BSCLIN.SR)
 3530 LET Q8=0
 3540 LET P3=3
 3550 IF Q7>=0 THEN LET P3=2
 3560 FOR Q9=1 TO Q3
 3570   LET P1=P[Q9]
 3580   LET P2=Q[Q9]
 3590   GOSUB 4230
 3600   LET Q8=Q8+1
 3610   IF Q8<>ABS(Q7) THEN GOTO 3660
 3620   LET U1=P[Q9]
 3630   LET U2=Q[Q9]
 3640   GOSUB 3730
 3650   LET Q8=0
 3660 NEXT Q9
 3670 RETURN
 3680 REM    ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

 1234567891123456789212345678931234567894123456789512345678961234567897
          0         0         0         0         0         0         0
```

```
C-O-N-T-I-N-U-O-U-S  F-L-O-W  A-N-A-L-Y-Z-E-R  A-U-T-O  S-Y-S-T-E-M
5/23/1980                                                    PAGE 10
                        PROGRAM LISTING FOR CFA20

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
3690 REM           SUBROUTINE TO PLACE MARKERS (BSCMKR.SR)
3700 DIM P5$[10]
3710 GOSUB 4130
3720 RETURN
3730 LET P1=U1-5
3740 LET P2=U2-8
3750 LET U3=P3
3760 LET P3=3
3770 GOSUB 4230
3780 PRINT "<29>";P4$;
3790 PRINT "<31>";P5$[1,LEN(P5$)]
3800 LET P1=U1
3810 LET P2=U2
3820 GOSUB 4230
3830 LET P3=U3
3840 RETURN
3850 REM    ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
3860 REM            SUBROUTINE TO DRAW AXES (BSCAXS.SR)
3870 LET P1=Q1
3880 LET P2=Q2
3890 LET P3=3
3900 GOSUB 4230
3910 LET P3=2
3920 IF ABS(Q5)=1 THEN GOTO 4020
3930 FOR Q6=1 TO Q3+1
3940   GOSUB 4230
3950   LET P2=P2+10*Q5/ABS(Q5)
3960   GOSUB 4230
3970   LET P2=P2-10*Q5/ABS(Q5)
3980   GOSUB 4230
3990   LET P1=P1+Q4
4000 NEXT Q6
4010 RETURN
4020 FOR Q6=1 TO Q3+1
4030   GOSUB 4230
4040   LET P1=P1+10*Q5/ABS(Q5)
4050   GOSUB 4230
4060   LET P1=P1-10*Q5/ABS(Q5)
4070   GOSUB 4230
4080   LET P2=P2+Q4
4090 NEXT Q6
4100 RETURN

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
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EPA-287 (Cin.)
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AND ILLUSTRATIONS

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C-O-N-T-I-N-U-O-U-S   F-L-O-W   A-N-A-L-Y-Z-E-R   A-U-T-O   S-Y-S-T-E-M
5/23/1980                                                          PAGE 11
                      PROGRAM LISTING FOR CFA20

1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
4110 REM   +++++++++++++++++++++++++++++++++++++++++++++++++<++++++++
4120 REM          SUBROUTINE TO PLOT INDIVIDUAL POINTS
4130 DIM P1$[32],P2$[32],P3$[32],P4$[4]
4140 LET P4=0
4150 LET P5=0
4160 LET P6=0
4170 LET P1$=" !<34>#$%&'()*+,-./0123456789:;<=>?"
4180 LET P2$="@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_"
4190 LET P3$="`ABCDEFGHIJKLM"
4200 LET P3$=P3$,"NOPQRSTUVWXY"
4210 LET P3$=P3$,"Z[\]^^"
4220 RETURN
4230 IF P3<>0 THEN GOTO 4270
4240 LET P4=P1
4250 LET P5=P2
4260 RETURN
4270 PRINT "<29>";
4280 IF LEN(P4$)<>0 THEN PRINT P4$[4,4];
4290 LET P7=INT(P1+P4)
4300 LET P8=INT(P2+P5)
4310 IF P7>1023 THEN LET P7=1023
4320 IF P7<0 THEN LET P7=0
4330 IF P8>780 THEN LET P8=780
4340 IF P8<0 THEN LET P8=0
4350 IF P3=2 THEN LET P6=1
4360 IF P3=3 THEN LET P6=0
4370 LET P9=INT(P8/32)
4380 LET P8=P8-(P9*32)+1
4390 LET P9=P9+1
4400 LET P4$=P1$[P9,P9],P3$[P8,P8]
4410 LET P9=INT(P7/32)
4420 LET P7=P7-(P9*32)+1
4430 LET P9=P9+1
4440 LET P4$=P4$,P1$[P9,P9],P2$[P7,P7]
4450 IF P6<>0 THEN GOTO 4470
4460 PRINT "<29>";
4470 PRINT P4$
4480 RETURN









1234567891123456789212345678931234567894123456789512345678961234567897
         0         0         0         0         0         0         0
```

```
C-O-N-T-I-N-U-O-U-S   F-L-O-W   A-N-A-L-Y-Z-E-R   A-U-T-O   S-Y-S-T-E-M
5/23/1980                                                          PAGE 12
                       SYMBOL TABLE FOR CFA20

SYMBOL    REFERENCES
------  -----------------------------------------------------------------
0140    1090
0170    0110  0290  0340  0580  2940  3130  3140  3150
0220    0130  0400
0240    0220
0300    0250
0350    0300
0390    0350
0410    0590  0600  0660
0460    0380
0530    0490
0550    0940
0590    0520  0540
0670    0610  0620  0630
0740    3160
0770    0950  0960  1020
0820    0740
0930    0890
0950    0920
1030    0970  0980  0990
1060    0760
1100    1070
1130    1060
1160    1120
1300    1230  1260  1280
1440    1410
1450    1430
2250    2180
2460    2400
2580    2540
2630    2470
2710    2680  2690
2810    2570  2600
2880    2860
2980    2910  3200
2990    1470
3020    2980
3080    3040
3140    3070  3090
3230    1910
3250    3300
3310    3260
3320    3350
3360    3320
3380    3410
3420    3380  3390
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C-O-N-T-I-N-U-O-U-S   F-L-O-W   A-N-A-L-Y-Z-E-R   A-U-T-O   S-Y-S-T-E-M
5/23/1980                                                        PAGE 13
                        SYMBOL TABLE FOR CFA20

SYMBOL   REFERENCES
------   ----------------------------------------------------------------
 3440    3460
 3470    3440
 3530    2460  2780
 3660    3610
 3700    0100
 3730    3640
 3870    1740  1770  2100  2130
 4020    3920
 4130    3710
 4230    1530  1560  1650  1830  2010  2320  2450  2510  2590  2760
         3590  3770  3820  3900  3940  3960  3980  4030  4050  4070
 4270    4230
 4470    4450
 A       0750  1030  1210  1220  1230  1240  1260  1280  1320  1330
         1340  1400  1410  1850  1880  2160  2340  2380  2400  2470
         2480  2490  2530  2560
 A$      0090  0900  0950  0960  0970  0980  0990  1030  2870  3050
         3140  3150  3160
 A2$     0090  0670  0800  1210
 A3$     0090  1170  1180  1190  1200  1210  1570  1580  1590  1940
         1950  1960  1970  2030
 C       1420  1440  1450  2660  2670
 D3      0730  1180
 D4      0730  1190
 D5      0730  1200
 F5      0710
 F5[     0680  1220
 F6      0720
 F6[     0680  1220
 FL#7    0360  0670  0690  0700  0710  0720  0730  1240  1350
 I       0790  0800  0810  0840  0850  0860  1130  1150  1340  1350
         1360  1400  1420  1440  1450  1460  1580  1590  1600  1610
         1620  1630  1640  1670  1680  1880  1890  1900  1990  2000
         2030  2040  2340  2350  2360  2370  2640  2650  2660  2710
         2810  2840  2990  3010
 I5[     0090  1350  1420  1440  1450  1890  2180  2190  2200  2210
         2220  2230  2240  2350  2360
 J       2160  2170  2260
 K       2170  2180  2190  2200  2210  2220  2230  2240  2250
 K5      0690
 K5[     0680  1220  1230  1260  1280  1410  2400  2470
 M       1240
 M[      0090  1250  1270  1290  1440  2660
 N       0670  0680  0740  0790  0840  0990  1350
 P1      1500  1800  2000  2290  2420  2480  2520  2560  2570  2730
```

```
C-O-N-T-I-N-U-O-U-S   F-L-O-W   A-N-A-L-Y-Z-E-R   A-U-T-O   S-Y-S-T-E-M
5/23/1980                                                        PAGE 14
                        SYMBOL TABLE FOR CFA20

SYMBOL   REFERENCES
------   ----------------------------------------------------------------
         3570  3730  3800  3870  3990  4040  4060  4240  4290
 P1$     4130  4170  4400  4440
 P2      1510  1540  1620  1630  1640  1810  1980  2300  2430  2490
         2530  2540  2550  2740  3580  3740  3810  3880  3950  3970
         4080  4250  4300
 P2$     4130  4180  4440
 P3      1520  1550  1820  2310  2440  2500  2580  2750  3540  3550
         3750  3760  3830  3890  3910  4230  4350  4360
 P3$     4130  4190  4200  4210  4400
 P4      4140  4240  4290
 P4$     1660  1840  2020  3780  4130  4280  4400  4440  4470
 P5      4150  4250  4300
 P5$     2330  3700  3790
 P6      4160  4350  4360  4450
 P7      4290  4310  4320  4410  4420  4440
 P8      4300  4330  4340  4370  4380  4400
 P9      4370  4380  4390  4400  4410  4420  4430  4440
 P[      0090  2350  2480  2530  2560  2670  2680  2690  2730  3570
         3620
 Q1      1690  1750  2050  3870
 Q2      1700  2060  2110  3880
 Q3      1710  2070  2380  2630  2650  2670  2680  2690  2700  2720
         3560  3930  4020
 Q4      1720  2080  3990  4080
 Q5      1730  1760  2090  2120  3920  3950  3970  4040  4060
 Q6      3930  4000  4020  4090
 Q7      2390  2410  2770  3550  3610
 Q8      3530  3600  3610  3650
 Q9      3560  3570  3580  3620  3630  3660
 Q[      0090  2360  2490  2530  2560  2650  2740  3580  3630
 R1      1310  1320  1330  1350
 S1      1860  3250  3270  3360  3430  3440  3450  3480
 S2      1870  1890  3250  3280
 S3      3250  3260  3320  3330  3360  3370  3380  3390  3400  3420
 S4      3310  3340  3420  3430  3450
 S5      3420  3440  3480
 S6      3470  3480  3490
 S7      0700  3240  3290  3480
 S7[     0680  1320  1330  1340  1400  1880  2160  2340  2380  2480
         2490  2530  2560
 S[      1920  1930  1950  1960  1970  2030  3230  3480
 T$      0090  0500  0590  0600  0610  0620  0630  1060  1070  1470
         2910
 U$      0090  0730  1850
 U1      3620  3730  3800
```

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```
C-O-N-T-I-N-U-O-U-S   F-L-O-W   A-N-A-L-Y-Z-E-R   A-U-T-O   S-Y-S-T-E-M
5/23/1980                                                         PAGE 15
                          SYMBOL TABLE FOR CFA20

SYMBOL    REFERENCES
------   ---------------------------------------------------------------
 U2      3630  3740  3810
 U3      3750  3830
 X5      1920  2350  2670
 X6      1930  2350  2670
 Z3      2190  2230
 Z4      2200  2240
```

SECTION 23

FILE STRUCTURES

RUN FILE AND RUN RESULTS FILE

A run file is a file in which data is passed from the Sample File Control System to the CFA System, and a run results file is a run file with the measured values filled in for return to the Sample File Control System. The names of run files always have the extension ".RF", and the names of run results files always have the extension ".RR". Run files created by the program CFA01 for non-Sample File Control users always have the name "0000000.RF". Run files and run results files are sequential files in INPUT/PRINT format.

Format for the Records in Run Files and Run Results Files

Header Record

Position	Contents
1	Record type (1)
2	Blank
3-4	Year
5	Blank
6-7	Month
8	Blank
9-10	Day
11	Blank
12-13	Hour
14	Blank
15-16	Minute
17	Blank
18-22	Measurement instrument ID, left justified
23	Blank
24-30	Parameter/method code
31	Blank
32-34	Analyst's initials
35	Blank
36-37	SFC flags, may be non-printing characters
38-80	Blank

Note: The date and time are those of the creation of the .RF. They are changed at the time of the creation of the .RR.

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Run Data Record

Position	Contents
1	Record type (2)
2	Blank
3-10	Lab sample ID
11	Blank
12-14	QC code
15	Blank
16	Parameter ID type
17	Blank
18-26	Parameter/method code, right justified
27	Blank
28-37	Result
38	Blank
39-46	Unit of measure, left justified
47	Blank
48-50	Non-numeric result
51	Blank
52-59	SFC record number
60	Blank
61-65	BK record number
66-80	Blank

Note: The BK record number is only present in the type 2 records for single analyte batches. For multi-analyte batches, the BK record number is in the type 6 records.

Run Time Data Record

Position	Contents
1	Record type (3)
2-4	Blank
5-14	Known value
15	Blank
16	Parameter ID type
17	Blank
18-26	Parameter/method code, right justified
27	Blank
28-37	Instrument signal
38	Blank
39-40	Instrument sample code, left justified
41-80	Blank

Note: The instrument sample codes are B (blank), S (calibration standard), CS (check standard), and T (timing set standard).

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Quality Control Limit Record

Position	Contents
1	Record type (4)
2	Blank
3-10	QC chart type, left justified
11	Blank
12-14	Limit type, left justified
15	Blank
16	Parameter ID type
17	Blank
18-26	Parameter/method code, right justified
27	Blank
28-37	Limit value
38	Blank
39-46	Date computed
47-80	Blank

Cancelled Run Data Record

The Cancelled Run Data Record is record type 5. Its format is identical to record type 2. Type 2 records can be transformed into type 5 records only in the run editing procedures of Sample File Control, and therefore, no type 5 records will ever be present in the CFA System.

Multi-Analyte Dummy Record

Position	Contents
1	Record type (6)
2	Blank
3-10	Lab sample ID
11	Blank
12-14	Number of analytes, filled field (e.g. "003")
15	Blank
16	Parameter ID type
17	Blank
18-26	Parameter/method code, right justified
26-47	Blank
48-50	Non-numeric result
51	Blank
52-59	SFC record number
60	Blank
61-65	BK record number
66-80	Blank

Note: A non-numeric result in a type 6 record applies to all of the analytes (all of the associated type 2 records).

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Order of the Records in Run Files and Run Results Files

Normal Sample

```
6_MERL1111_003_P___PPPPPPP....
2_MERL1111_____P___AAAPPPP....
2_MERL1111_____P___BBBPPPP....
2_MERL1111_____P___CCCPPPP....
```

Sample Which Has a Spike Later in the Sample Wheel

```
6_MERL2222_003_P___PPPPPPP....
2_MERL2222_LSO_P___AAAPPPP....
4_LSPK_____UCL_P___AAAPPPP....
4_LSPK_____UWL_P___AAAPPPP....
4_LSPK_____AVE_P___AAAPPPP....
4_LSPK_____LWL_P___AAAPPPP....
4_LSPK_____LCL_P___AAAPPPP....
2_MERL2222_LSO_P___BBBPPPP....
4_LSPK_____UCL_P___BBBPPPP....
4_LSPK_____UWL_P___BBBPPPP....
4_LSPK_____AVE_P___BBBPPPP....
4_LSPK_____LWL_P___BBBPPPP....
4_LSPK_____LCL_P___BBBPPPP....
2_MERL2222_LSO_P___CCCPPPP....
4_LSPK_____UCL_P___CCCPPPP....
4_LSPK_____UWL_P___CCCPPPP....
4_LSPK_____AVE_P___CCCPPPP....
4_LSPK_____LWL_P___CCCPPPP....
4_LSPK_____LCL_P___CCCPPPP....
```

Spike of the Sample Above

```
6_MERL2222_003_P____PPPPPPP....
2_MERL2222_LSF_P____AAAPPPP....
2_MERL2222_LSA_P____AAAPPPP....
2_MERL2222_LSF_P____BBBPPPP....
2_MERL2222_LSA_P____BBBPPPP....
2_MERL2222_LSF_P____CCCPPPP....
2_MERL2222_LSA_P____CCCPPPP....
```

Any additional spikes of the same sample would have exactly the same series of records.

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Sample Which Has a Duplicate Later in the Sample Wheel

```
6_MERL3333_003_P___PPPPPPP....
2_MERL3333_LD1_P___AAAPPPP....
4_LDUP_____A___P___AAAPPPP....
4_LDUP_____B___P___AAAPPPP....
4_LDUP_____C___P___AAAPPPP....
4_LDUP_____D___P___AAAPPPP....
2_MERL3333_LD1_P___BBBPPPP....
4_LDUP_____A___P___BBBPPPP....
4_LDUP_____B___P___BBBPPPP....
4_LDUP_____C___P___BBBPPPP....
4_LDUP_____D___P___BBBPPPP....
2_MERL3333_LD1_P___CCCPPPP....
4_LDUP_____A___P___CCCPPPP....
4_LDUP_____B___P___CCCPPPP....
4_LDUP_____C___P___CCCPPPP....
4_LDUP_____D___P___CCCPPPP....
```

Duplicate of the Sample Above

```
6_MERL3333_003_P___PPPPPPP....
2_MERL3333_LD2_P___AAAPPPP....
2_MERL3333_LD2_P___BBBPPPP....
2_MERL3333_LD2_P___CCCPPPP....
```

Any additional duplicates of the sample would have exactly the same series of records except that the QC code would be LD3, LD4, LD5, etc.

Sample Which has a Spike and a Duplicate Later in the Sample Wheel

```
6_MERL4444_003_P____PPPPPPP....
2_MERL4444_LDX_P____AAAPPPP....
4_LSPK_____UCL_P____AAAPPPP....
4_LSPK_____UWL_P____AAAPPPP....
4_LSPK_____AVE_P____AAAPPPP....
4_LSPK_____LWL_P____AAAPPPP....
4_LSPK_____LCL_P____AAAPPPP....
4_LDUP_____A___P____AAAPPPP....
4_LDUP_____B___P____AAAPPPP....
4_LDUP_____C___P____AAAPPPP....
4_LDUP_____D___P____AAAPPPP....
2_MERL4444_LDX_P____BBBPPPP....
4_LSPK_____UCL_P____BBBPPPP....
4_LSPK_____UWL_P____BBBPPPP....
4_LSPK_____AVE_P____BBBPPPP....
4_LSPK_____LWL_P____BBBPPPP....
4_LSPK_____LCL_P____BBBPPPP....
4_LDUP_____A___P____BBBPPPP....
4_LDUP_____B___P____BBBPPPP....
4_LSUP_____C___P____BBBPPPP....
4_LDUP_____D___P____BBBPPPP....
```

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```
2 MERL4444 LDX P    CCCPPPP....
4 LSPK     UCL P    CCCPPPP....
4 LSPK     UWL P    CCCPPPP....
4 LSPK     AVE P    CCCPPPP....
4 LSPK     LWL P    CCCPPPP....
4 LSPK     LCL P    CCCPPPP....
4 LDUP     A   P    CCCPPPP....
4 LDUP     B   P    CCCPPPP....
4 LDUP     C   P    CCCPPPP....
4 LDUP     D   P    CCCPPPP....
```

The spike(s) and duplicate(s) of this sample would have exactly the same series of records as those shown before.

Reagent Blank

```
6          003 P    PPPPPPP....
2          LRB P    AAAPPPP....
4 LRBL     UCL P    AAAPPPP....
4 LRBL     UWL P    AAAPPPP....
4 LRBL     AVE P    AAAPPPP....
4 LRBL     LWL P    AAAPPPP....
4 LRBL     LCL P    AAAPPPP....
2          LRB P    BBBPPPP....
4 LRBL     UCL P    BBBPPPP....
4 LRBL     LWL P    BBBPPPP....
4 LRBL     AVE P    BBBPPPP....
4 LRBL     LWL P    BBBPPPP....
4 LRBL     LCL P    BBBPPPP....
2          LRB P    CCCPPPP....
4 LRBL     UCL P    CCCPPPP....
4 LRBL     UWL P    CCCPPPP....
4 LRBL     AVE P    CCCPPPP....
4 LRBL     LWL P    CCCPPPP....
4 LRBL     LCL P    CCCPPPP....
```

Laboratory Control Standard

```
6          003 P    PPPPPPP....
2          LCM P    AAAPPPP....
2          LCT P    AAAPPPP....
4  LCST    UCL P    AAAPPPP....
4  LCST    UWL P    AAAPPPP....
4  LCST    AVE P    AAAPPPP....
4  LCST    LWL P    AAAPPPP....
4  LCST    LCL P    AAAPPPP....
2          LCM P    BBBPPPP....
2          LCT P    BBBPPPP....
4  LCST    UCL P    BBBPPPP....
4  LCST    UWL P    BBBPPPP....
4  LCST    AVE P    BBBPPPP....
```

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```
4__LCST___LWL__P____BBBPPPP....
4__LCST___LCL__P____BBBPPPP....
2_________LCM__P____CCCPPPP....
2_________LCT__P____CCCPPPP....
4__LCST___UCL__P____CCCPPPP....
4__LCST___UWL__P____CCCPPPP....
4__LCST___AVE__P____CCCPPPP....
4__LCST___LWL__P____CCCPPPP....
4__LCST___LCL__P____CCCPPPP....
```

Timing Set Standard

```
3______________P____AAAPPPP....
3______________P____BBBPPPP....
3______________P____CCCPPPP....
```

Blank

```
3______________P____AAAPPPP....
3______________P____BBBPPPP....
3______________P____CCCPPPP....
```

Check Standard

```
3___±D.DDDE±DD_P____AAAPPPP....
3___±D.DDDE±DD_P____BBBPPPP....
3___±D.DDDE±DD_P____CCCPPPP....
```

Calibration Standard

```
3___±D.DDDE±DD_P____AAAPPPP....
3___±D.DDDE±DD_P____BBBPPPP....
3___±D.DDDE±DD_P____CCCPPPP....
```

TEMPORARY LIST FILE (CFA000)

The temporary list file is named CFA000. It is a sequential file in INPUT/PRINT format. It is in this file that all reports are assembled before they are printed on the lineprinter or terminal. The file simply contains the lines of the report as strings.

CALIBRATION AND SAMPLE TEMPLATE FILE (CFA001)

The calibration and sample templates file is named CFA001. It is a random access file having 80-byte records. It is in the READ/WRITE format.

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Record 0 contains N (the number of analytes), A1$ (the superstring of the names of the analytes), N1 (the number of calibration standards), N3 (the total number of positions in the sample template), and N9 (the number of positions for unknowns in the sample template).

Records 1 through 5*N+N1*N constitute the calibration template. Records 1 through 3*N are the template records for timing set standards. Records 3*N+1 through 5*N are the template records for the blanks at the begining of the batch. Records 5*N+1 through 5*N+N1*N are the template records for the calibration standards.

Records 5*N+N1*N+1 through 5*N+N1*N+N3(N+1) constitute the sample template.

The formats of the individual records are identical to those of the run file.

QUALITY CONTROL LIMITS FILE (CFA002)

The quality control limits file is named CFA002. It is a random access file having 80-byte records. It is in READ/WRITE format.

Record 0 contains A1$, the superstring of the parameter methods codes. Records 1 through 5 contain the quality control limits for spiked samples for the first analyte, in the format described for type 4 run file records. Similarly, records 6 though 10 contain the quality control limits for laboratory control standards for the first analyte, records 11 through 15 contain the quality control limits for reagent blanks for the first analyte, and records 16 through 20 contain the quality control limits for duplicates for the first analyte.

Records 21 through 40 contain the quality control limit records for the second analyte, if any. Records 41 through 60 contain those for the third analyte, if any.

REDUCED DATA FILE (CFA003)

The reduced data file is named CFA003. It is a random access file having 56-byte records. It is in read/write format.

Record 0 contains N (the number of analytes), A2$ (the superstring of parameter method codes), R9$ (the name of the run file used to create CFA003), W (the number of wheel positions represented in CFA003), W2 (the number of positions in one sample wheel), and Z (a flag for which a value of 0 indicates that the final results have not been calculated, and a value of 1 indicates that they have.)

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For each wheel position, CFA003 contains one record of data common to all of the channnels, and one, two, or three records of data specific to the individual channels.

The common data for wheel position W is located in record number (W-1)*(N+1)+1, where N is the number of channels. The record contains C(1) (the sample type code), C(2) (the volume before dilution), C(3) (the volume of the dilution water), C(4) (the wheel position of the associated sample, if any), and S$ (the sample ID number).

The specific data for the Ith channel of wheel position W is located at record number (W-1)*(N+1)+1+I, where N is the number of analytes. The record contains S(1) (the raw peak height), S(2) (the baseline corrected peak height), S(3) (the upper control limit), S(4) (the uppper warning limit), S(5) (the average recovery), S(6) (the lower warning limit), S(7) (the lower control limit), S(8) (the A value in the control limits for duplicates), S(9) (the B value), S(10) (the C value), S(11) (the D value), S(12) (the calculated concentration), S(13) (the theoretical concentration), and S(14) (the run file record number for this result).

AUTOMATION PARAMETERS FILE (CFA004)

The automation parameters file is named CFA004. It is a random access file having 22-byte records. It is in READ/WRITE format.

Record 0 contains A2$, the superstring of parameter-method codes. Record 1 contains T4, the time between peaks, in seconds, and U$, the superstring of default units. Record 2 contains R6, R7, and R8. If the user requests a subtracted results report, R6 is a 1, R7 is the position in A2$ of the minuend analyte, and R8 is the position in A2$ of the subtrahend analyte. If the user does not request a subtracted results report, all three numbers are zeros.

Record 3 contains D, the additional dilution factor for offscale samples, or a zero to indicate that the additional dilution factor is variable.

Record 4 contains U5(), the array of analogue to digital converter channel numbers. Record 5 contains B6(), the array of set standard threshold values. Record 6 contains U6(), the array of data acquisition window widths. Record 7 contains G9(), the array of the standard deviations defining levelness. Record 8 contains K5(), the array of the degrees of least squares fit, or zeros to indicate interpolation. Record 9 contains W5(), the array of detection limit concentrations. Record 10 contains W6(), the array of offscale concentrations. Record 11 contains I3(), the array of allowable errors for check standards. If program CFA07 has not yet been executed, this is the end of file CFA004.

After the execution of CFA07, the file also contains in record 12 the array B7(), the array of analogue to digital converter readings at full scale. Record 13 contains B8(), the array of analogue to digital

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converter readings at proper damping. Record 14 contains A7, a flag for which a value of zero indicates that the automated run is unattended, and a value of 1 indicates that the automated run is attended. If the program CFA08 has not yet been executed, this is the end of file CFA004.

After the execution of CFA08, the file also contains in record 15 the array B(), the array of current baseline heights at the time of calibration. Record 16 contains G7(), the array of the lowest peak heights which may effect the timing. Record 18 contains L(), the array of the peak numbers of the last peaks to mandate timing adjustments at the time of calibration. Record 19 contains P8(), the array of the expected positions of the next peaks at the time of calibration. Record 20 contains S8(), the array of the amounts of timing shift for the last timing change at the time of calibration. Record 21 contains P, the current peak number at the time of calibration.

Record 22 contains S7(), the array of the numbers of standards. Record 23 contains F5(), the array of the calibration fitting errors. Record 24 contains F6(), the array of the forced origin fitting errors.

Records beyond record 24 contain M(), the array of the coefficients of the calibration equations. Records 25, 26, and 27 may be used for this purpose.

RAW DATA FILE (CFA005)

The raw data file is named CFA005. It is a random access file having 240-byte records. It is in READ/WRITE format.

Record 0 contains N (the number of analytes), A2$ (the superstring of parameter-method codes), and W7 (the number of wheel positions for which there is raw data).

This file contains two records for each peak. The first record contains H8 (the height at the expected position), H9 (the height at the highest level position), P9 (the expected position), Y (the code for the algorithm applied), and Z (the amount of timing shift in seconds). The second record for the peak contains D2(), the array of the sixty readings from the analogue to digital converter.

The records are arranged in order by wheel position and by analyte. For example, for a three-analyte batch, the file would be arranged as follows:

Wheel Position 1 - Two records for analyte 1
Two records for analyte 2
Two records for analyte 3

Wheel Position 2 - Two records for analyte 1
Two records for analyte 2
Two records for analyte 3

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Wheel Position 3 - Two records for analyte 1
Two records for analyte 2
Two records for analyte 3

SECOND-TERMINAL CALIBRATION PLOT FILE (CFA006)

The second-terminal calibration plot file is named CFA006. It is a random access file having 26-byte records. It is in READ/WRITE format.

Record 0 contains N (the number of analytes) and A2$ (the superstring of the names of the analytes).

Record 1 contains K5(), the array of types of fit. Record 2 contains S7(), the array of the numbers of calibration standards. Record 3 contains F5(), the array of the calibration fitting errors. Record 4 contains F6(), the array of the forced origin fitting errors. Record 5 contains D3 (the month), D4 (the day), D5 (the year), and U$ (the superstring of default units).

Records 6 through 5+N contain M(), the array of the coefficients of the calibration equation.

Records 6+N and following contain a baseline corrected peak height and a theoretical concentration for a standard. The standards for the first analyte are first, those for the second analyte (if any) are second, and those for the third analyte (if any) are third.

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